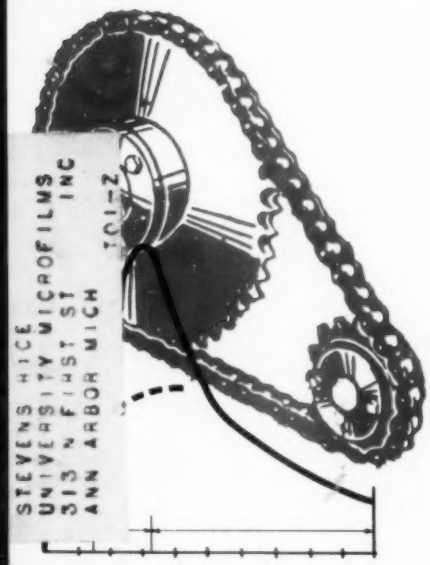
POWER TRANSMISSION DESIGN

MARCH 1961

INCLUDING BEARINGS DESIGN/APPLICATION

New Roller Chain Standards Boost HP Ratings



STEVENS HICE
UNIVERSITY MICROFILMS INC
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Hot Bearing Research Gives Designers New Facts

ALSO IN THIS ISSUE:

Twin turbines in harness
No planets for earthmover transmission
Crossconnected engines drive blimp

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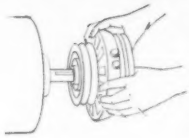
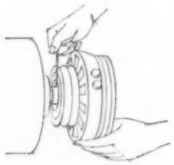
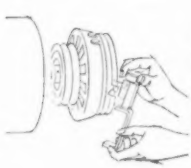


1 Entire assembly slips over any standard NEMA motor shaft. No machining necessary.



2 With clutch-sheave package in place, set-screws secure built-in shaft extension.



3 Mount brushholder to motor frame, wire to control panel. Warner's Electro-Sheave is ready!

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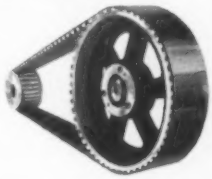
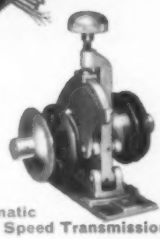


Positive Drives

Super
Wedge Drives

Variable Speed
Drives



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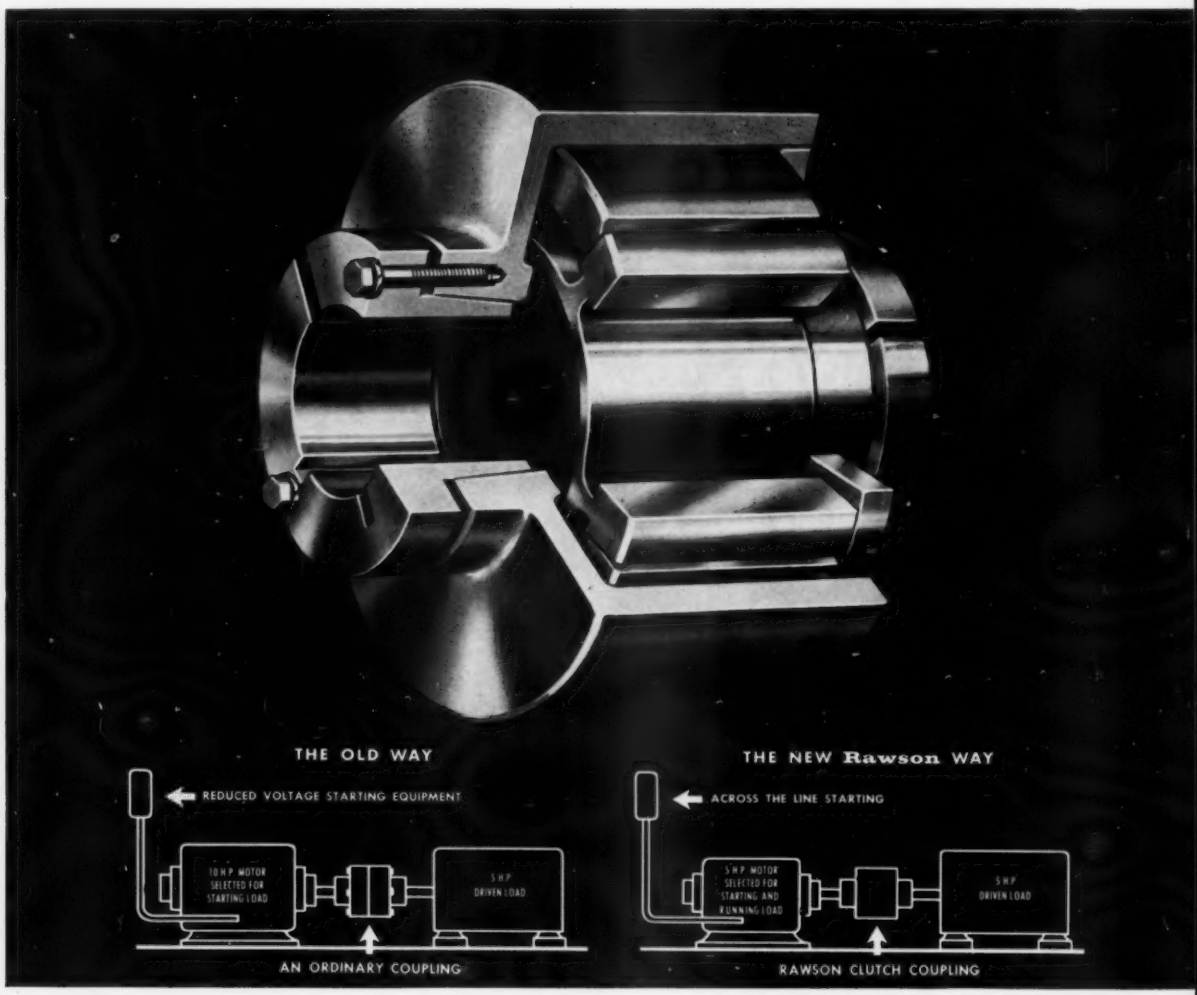
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REDUCED VOLTAGE STARTING EQUIPMENT
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5 H.P. DRIVEN LOAD
AN ORDINARY COUPLING
THE NEW Rawson WAY
ACROSS THE LINE STARTING
5 H.P. MOTOR SELECTED FOR STARTING AND RUNNING LOAD
5 H.P. DRIVEN LOAD
RAWSON CLUTCH COUPLING

HERE'S WHAT RAWSON CLUTCHES WILL DO FOR YOU

NO-LOAD MOTOR STARTS – Rawson clutches engage at a pre-selected RPM, therefore motors start under "no-load" conditions. Thus, starting current is lower and motor acceleration time is reduced to a fraction of a second.

SMOOTH, SHOCK-FREE STARTING – For any load from fractional to 3,000 horsepower, Rawson starts are smooth and gradual. Even the most delicate equipment and fragile materials are protected.

NO POWER LOSS – At normal running speed, Rawson clutches operate with zero percent power loss. Fluid type clutches have at least a 4% loss.

ACROSS-THE-LINE STARTING –The purchase of costly reduced voltage starting equipment is no longer required. With Rawson "no-load" starts, motors can utilize low-cost across-the-line starting.

YOU CAN USE SMALLER MOTORS –With Rawson "no-load" motor starts and cushioned starting of loads, motor size can be selected for running power only–this may reduce required motor capacity by as much as one-half. Also, on high inertia loads, Rawson clutches eliminate the need for expensive high-torque motors–standard NEMA B motors can be used.

CONTROLLED ENGAGEMENT–Centrifugal force causes a Rawson clutch to gradually engage at a pre-selected RPM as it is brought up to running speed. Engagement can be further controlled by using Rawson clutches having a delayed engagement feature. For internal combustion engines and turbine applications, this delayed engagement feature assures "no-load" during warm-up periods. Delayed engagement Rawsons are also ideally suited for dual drive (standby) installations.

AUTOMATIC OVERLOAD PROTECTION – Power transmission system components are never subjected to the stresses of a continuing overload–Rawson clutches automatically slip until the overload condition is corrected.

FREQUENT MOTOR REVERSAL–Because the Rawson design permits driving in either direction, provides "no-load" motor starts, and assures smooth starting of driven equipment, frequent load reversals are accomplished without overheating the motor.

REDUCED MAINTENANCE COSTS – Shock loadings are absorbed by Rawson clutches–stresses are not transmitted to gear trains or other components of drive system. Thus, expensive repairs and downtime are kept to a minimum.

NEW RAWSON

CENTRIFUGAL CLUTCHES & CLUTCH-COUPLINGS

Permit Use of Smaller Motors . . . Lower Starting Equipment Costs . . . Provide Cushioned Starting of Driven Equipment . . . Automatic Overload Protection

Rawson clutches and clutch-couplings are of all-metal construction to assure longer life and maximum horsepower capacity per size. They drive in either direction and provide slip-free power at normal operating speeds for applications up to 3000 horsepower.

Because the Rawson design permits "no-load" starting of motors: acceleration time is much faster; starting current is greatly decreased; across-the-line starting can replace costly reduced voltage equipment; and based on lower starting current required, smaller motors can often be employed.

The cushioned starting feature of Rawson clutches frequently permits using NEMA "B" or standard squirrel-cage motors for high inertia loads instead of expensive special high-torque motors. Also, delicate equipment is protected by this elimination of starting shock. On any type of equipment, overloading or jamming will cause a Rawson clutch to slip—protection is automatic and positive.

Rawson clutches function as direct-drive clutch-couplings (in-line, shaft-to-shaft connection) or as indirect-drive clutches through V-belts, chains or gearing. For internal combustion engines and turbine applications, Rawsons can be furnished with a delayed engagement feature that provides "no-load" starting and warm-up idling. As the driving unit is accelerated, the Rawson will engage at a pre-selected R.P.M. There is no slipping or power loss at normal running speed. This same delayed engagement feature makes Rawson clutches ideal for dual drive or standby applications—automatic disconnect and predetermined engagement speed is provided for both prime movers.

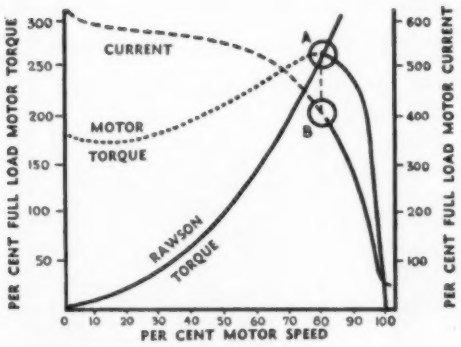
Rawson clutches are simple in design for economy and reliability; they never require adjustment; heat-checking and brake-fade are eliminated; indirect drive clutches utilize standard "QD" type sheaves and direct drive clutch-couplings use "QD" type bushings for ready adaptability to every standard shaft size.

For higher efficiency, lower costs, reduced maintenance and full overload protection, specify Rawson automatic centrifugal clutches and clutch-couplings. These modern centrifugal clutches and their applications are fully described in the Rawson catalog—ask your Rawson distributor or write for your copy.

FORMSPRAG COMPANY

23587 Hoover Road, Dept. 109-A • Warren (Detroit), Michigan

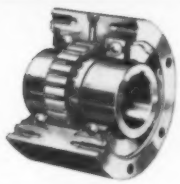
Precision Power Transmission Products



Typical torque and current characteristics of a standard NEMA B motor. Because Rawson clutch does not fully engage until after peak torque speed "A" is reached, motor acceleration time is much faster, peak current period is greatly decreased and motor operates more efficiently "B". Thus, smaller motors and across-the-line starting can be used.

OTHER FORMSPRAG PRECISION POWER TRANSMISSION PRODUCTS

FORMSPRAG
Over-Running Clutches



These modern sprag-type clutches provide greatest torque, precision and life on any over-running, indexing or back-stopping application.

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Dual Torque-Locking & Positioning Devices

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POWER TRANSMISSION DESIGN®

THE MAGAZINE OF MACHINE DRIVES

MARCH 1961

volume 3 number 3

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An automatic countershaft-type transmission does a good job in a heavy-duty application.

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Hydrostatic drives show up well on a demanding duty cycle.

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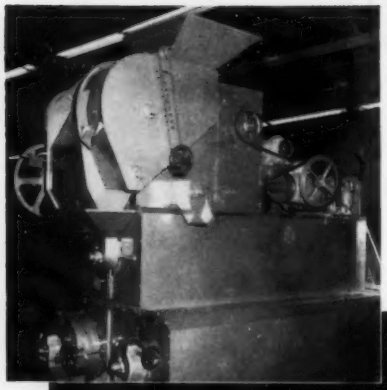
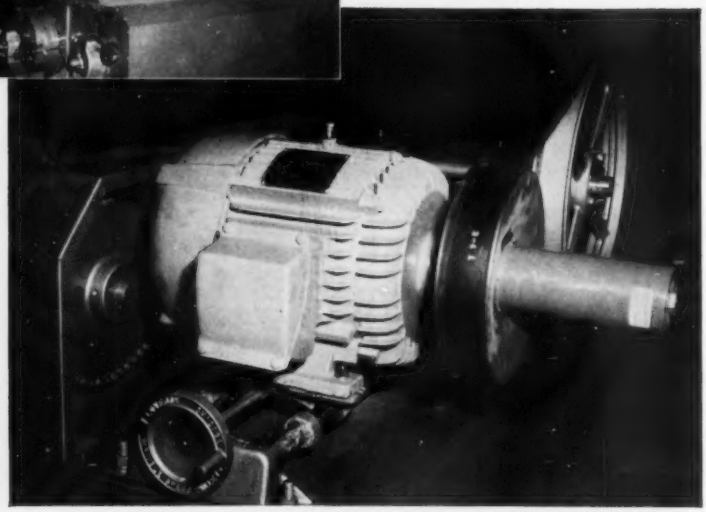
Why Lovejoy Vari-Speed Equipment Drives This Precision Processing Machine



Known as the "Dominion Minor", this grain processing machine* is a multi-cylinder unit which scalps, aspirates and makes five clean cut separations on all types of grain.

Lovejoy Vari-Speed components used are:

No. 3050 5-hp. Variable Speed Pulley
No. 720-18 Belt and
No. 18 Drive Sheave
No. 303-C Motor Base



. . . for accuracy and great flexibility

"Cleaning and grading grain for seed is an exacting process which requires a machine of great accuracy and flexibility," the manufacturer reports. "To assure maximum accuracy and flexibility we use Lovejoy Vari-Speed Components on our new multi-cylinder machine."

. . . for quality, service and price

We also chose Lovejoy Vari-Speed Components because of quality, service and price. Our new machine has stood the test of heavy duty field service with no problems whatsoever."

Lovejoy's full line of vari-speed equipment includes variable speed pulleys, variable speed transmissions and bases for all NEMA frame sizes. Why not request recommendations for your application? Ask for catalog 61-B for general information. Also ask for literature on flexible couplings, universal joints and shaft mounted gear reducers.

Name of manufacturer on request

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*Standardized accessories to provide these features are available for all sizes of Roto-Mission from stock. This results in a single responsibility for installation performance.

This new rotary transmission design combines a wide range of reduction ratios, high torque capacities, and excellent space-saving characteristics to give you more application versatility than ever before possible. It is designed to be concentrically mounted on a machine drive shaft in place of the drive pulley and operate this shaft at a reduced speed from that of the driving motor. For maximum compactness and convenience, all its parts are inside the casing.

The standard accessories available for each model of Roto-Mission add even greater versatility. Through them you have systems—from a single source—capable of control functions that previously required a number of unmatched units from several suppliers.

Because of its versatility and sound engineering, Roto-Mission permits you to solve design problems far beyond the range of other transmissions —may even permit incorporation of features in your machines that have not previously been possible. For complete information on this new product—how it operates and how it can help you —write today for catalog IR-61.

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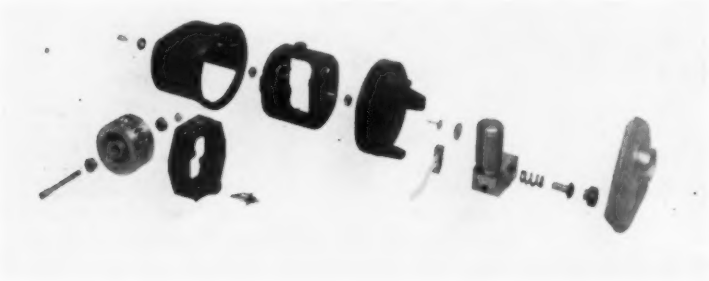
NEWS

from the power transmission field

Nitro-cellulose drives missile gyro

A missile, in spite of its technological glamour, is just a round of ammunition. Whenever possible its instruments should be simple, reliable and cheap.

Designers of Lear's "Genie", a two-degree-of-freedom displacement gyro for short flight missile guidance, have come up with just such an instrument. It uses a hot gas impulse turbine which is a simpler, more reliable, and quicker method of accelerating the motor than either electric or mechanical drives. It has only four moving components—three gyro axes and the uncaging mechanism. Of the complete parts layout shown, a few are purchased specialty items like the slip ring and brush assembly and bearings. All the rest are either screw-machine or die cast parts—stainless steel or aluminum.



The energy transfer system is simple as the construction. A cartridge of nitro-cellulose propellant (double base, type BK-5) is fired by an electric pulse. The combustion gases, at pressures of several thousand psi, leave the combustion chamber and are exhausted over the buckets of the turbine rotor through a convergent-divergent nozzle. This nozzle is fixed to the inner gimbal. Gas reaches it through a tube-like snorkel which passes through the outer gimbal. The snorkel is spring-loaded in this position, locking or caging both gimbals until the go signal is given the gyro. The first high pressure impulse compresses the snorkel spring slightly more than normal so that the pressure displaces a snorkel-locking pin. Then at the instant of the gas pressure decline, when the wheel has been accelerated to maximum speed, the spring retracts the snorkel, thereby uncaging the gyro. The entire starting-uncaging sequence takes approximately 85 milli-seconds.

Choice of an impulse turbine rather than a reaction jet rotor gives several significant advantages: the inertia of a solid steel wheel is, naturally, much higher than that of a propellant-filled wheel after blow-down; the reversed flow of hot gas impinging on the turbine buckets provides at least a 2:1 advantage over the reaction jet; and there are no rotor balance anomalies as sometime occur with the reaction wheel design.

Although designed for one shot, the Genie gyro can be re-used. The combustion gases are non-toxic and non-corrosive, so that after replacing the propellant, cleaning, recaging and resealing, it's ready for another go.

The BEST Solution to Difficult Speed Control Problems—

Dynamatic Liquid-Cooled Couplings provide infinitely adjustable speeds for nearly every application from 3 to 75 HP. Note the absence of slip rings, brushes, and commutators. Heavy-duty types with capacities up to 5,000 HP are also available.

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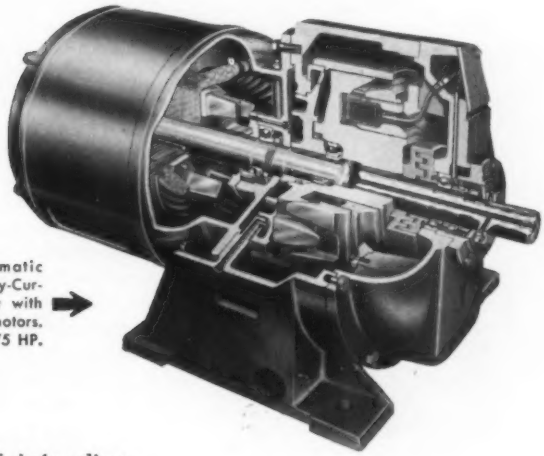
DYNAMATIC®

LIQUID-COOLED EDDY-CURRENT COUPLINGS and DRIVES



"Dynaspede" Drives are Dynamatic Liquid-Cooled, Stationary-Field Eddy-Current Couplings mounted integrally with standard, D-flange, squirrel cage motors. Available in capacities from 3 to 75 HP.

Here's Why—

Dynamatic Liquid-Cooled Couplings and Drives provide infinitely adjustable speed from a constant speed source—or constant speed from a variable speed source. They operate on standard alternating current. Rotary power is transmitted through the coupling by an electromagnetic reaction between the driving and driven members of the unit—there is no mechanical contact of rotating members to cause wear and require adjustment or replacement.

A wide range of standard and special control features may be obtained from a remotely-mounted electronic control system. Infinite speed adjustment, constant speed control, on-off clutch control, torque limit, acceleration control, inching, and threading are a few of the many functions available. The addition of an eddy-current brake to standard couplings or drives provides smooth, cushioned stops and controlled deceleration.

Liquid-Cooled Dynamatic Couplings and Drives deliver more horsepower than other types of the same physical size, thus conserving space in a busy machine area. Efficient heat dissipation permits continued operation at low speeds, or stall with full load.

Completely enclosed, Dynamatic liquid-cooled units are protected from dust, dirt, and other atmospheric impurities. Dynamatic design involves no brushes or slip rings; there is no possibility of arcing. With simple modification these units can be made explosion-resistant for hazardous applications.

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★

Full-Torque Starts

★

Wide Range of Control Functions

★

No Slip Rings, Brushes or Commutators

★

Completely Enclosed Design

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for power transmission

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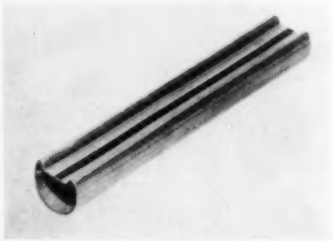
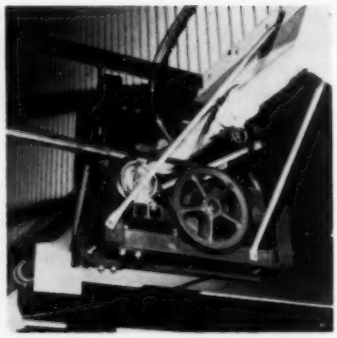
NEWS

Shaped tubing makes lube-free V-belt channel



Specially shaped welded steel tubing serves as a channel for a special type of V-belting in an unusual materials handling system. It was installed recently in the distribution center of Bobbie Brooks, Inc., a large Cleveland clothing manufacturer.

The conveyor, known as the V-Matic, is about five miles long, designed to handle 60,000 units a day, and is capable of speeds of over 100 ft per minute. It carries clothes on hangers from trucks at the receiving docks to stock and order filling areas. This was once a three to six hour job, now takes 30 minutes or less.



The V-belt forms a complete circuit, riding on top of the tube to convey the clothing and returning inside. This removes the need for a second support structure for the return line. Fractional hp motors pull the belt through the steel track. Since there is no metal-to-metal contact as in most conveyor setups, there is hardly any noise. Moreover, with no oiling or greasing needed, there's no possibility of soiling the fabrics being moved.

This novel network was developed by engineer V. A. Juengel of Cleveland, with assistance from Republic Steel and Goodyear. Republic crescent-shaped the $1\frac{3}{8}$ in. OD tubing to specification. Weighing less than .7 lb per foot, it doesn't require the bulky supports common with conveyor systems. The belt from Goodyear is specially ridged to convey materials up very steep inclines.

According to the inventor, the V-Matic is adaptable to a wide number of industries and offers a per-foot cost much lower than the cheapest materials-handling systems now available.

Report tells why silicone oils last longer

Silicone oils last three to five times longer through the use of oxidation inhibitors effective in other systems, says the U. S. Navy. A research report of a study of the stabilization of silicone oils at

temperatures between 250-371 C. has been released by the Office of Technical Services, U. S. Department of Commerce, Washington. It shows that high surface solids such as Shawanigan black or copper phthalocyanine inhibit oxidation as do conventional inhibitors of the arylamine type, and dilauryl selenide. Effectiveness varies within the given temperature range; the gains from any inhibitor were small at 371 C. The chemical diversity of the inhibitors suggests that the mechanism of inhibition in silicone oils differs from that of conventional oils at temperatures below 200 C. Research is continuing to develop new types of inhibitors specifically for use with silicone liquids.

Also available is an Air Force report on the effect of varying degrees of humidity on the consistency of 22 greases in storage. It concludes soap-thickened mineral oil greases are more likely to be stable in a moist atmosphere than soap-thickened synthetic fluid or nonsoap thickened greases. For testing, the greases were stored for seven months at relative humidities of 0, 50 and 100 per cent.

The two reports are:

The Stabilization of Silicone Lubricating Liquids Above 200 C: Part 1—Conventional Oxidation Inhibitors and Some High Surface Solids. H. R. Baker and others, 33 pages, price $1.

The Effect of Humidity on the Consistency of Greases. M. T. Fisher. Price 50c.

AFBMA Standard Section 6

The Anti-Friction Bearing Manufacturers Association has issued a new edition of Standard Section 6, Revision No. 2, January 1961.

This revision is in line with the recommendations made by the packaging Subcommittee and approved by the ABEC and RBEC. This Standard is also applicable for roller bearings.

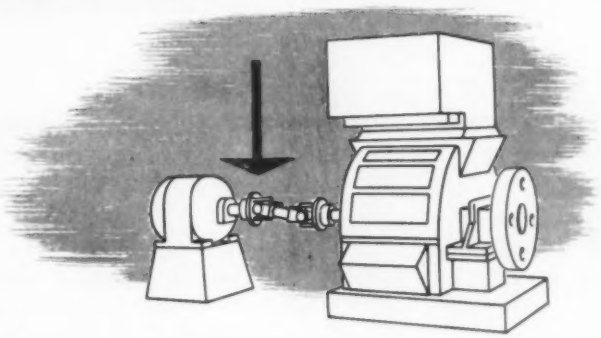
Additional copies are available at forty cents each, plus postage of eight cents, on single copy orders, from AFBMA, 60 East 42nd St., New York 17, N. Y.

How to make

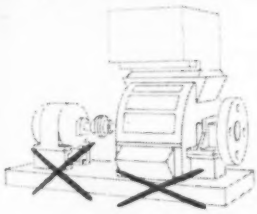
"MISALIGNMENT"

profitable with

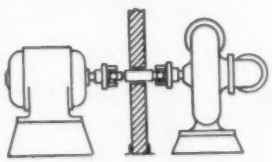
WATSON Drive Shafts



A WATSON drive shaft working at any angle from 1 to 8 degrees transmits power as efficiently as a flexible coupling, yet offers substantial savings in design engineering time and installation cost. Angles up to 20 degrees can be handled (depending on RPM). No painstaking axial alignment is required; simple, low-cost concrete foundations poured on the site replace costly unit base plates.



In addition, the use of Watson drive shafts offers:



WIDEST LATITUDE IN LOCATION
of driving and driven elements for best utilization of space, distribution of weight, isolation of motor or engine, provision for maintenance or working space.

PROVISION FOR RELATIVE MOVEMENT
between driving and driven elements, either intentional or as a result of structural deflection or foundation shifts.

WATSON drive shafts are promptly available in 9 sizes, 10 to 800 h.p., for speeds to 4,000 r.p.m. and more. Why not get the facts—now? New 8-page Engineering Data Bulletin F-15a is yours for the asking; please address Dept. 150

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Your Machines
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SPECIFY THOMAS
FLEXIBLE COUPLINGS

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Troublesome maintenance problems and down time are eliminated when you specify Thomas "All-Metal" Flexible Couplings to protect your equipment and extend the life of your machines.

UNDER LOAD and MISALIGNMENT only THOMAS FLEXIBLE COUPLINGS offer all these advantages:

- Freedom from Backlash
- Torsional Rigidity • Free End Float
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NEWS

Plastic housings for jet engines

Plastics in the form of glass-reinforced phenolics and polyesters have entered another field in the aircraft industry, according to C. H. Vondracek and R. N. Sampson, of the Westinghouse Electric Corp.'s Materials Lab. In a paper to the 17th Annual Technical Conference of the Society of Plastic Engineers in Washington, the authors gave details of a gas turbine compressor housing fabricated of high-temperature plastics rather than the traditional magnesium alloys.

Plastics do not corrode and estimates show that the cost of plastic housings is about half that of metals—mainly because close tolerances in plastics can be obtained without machining.

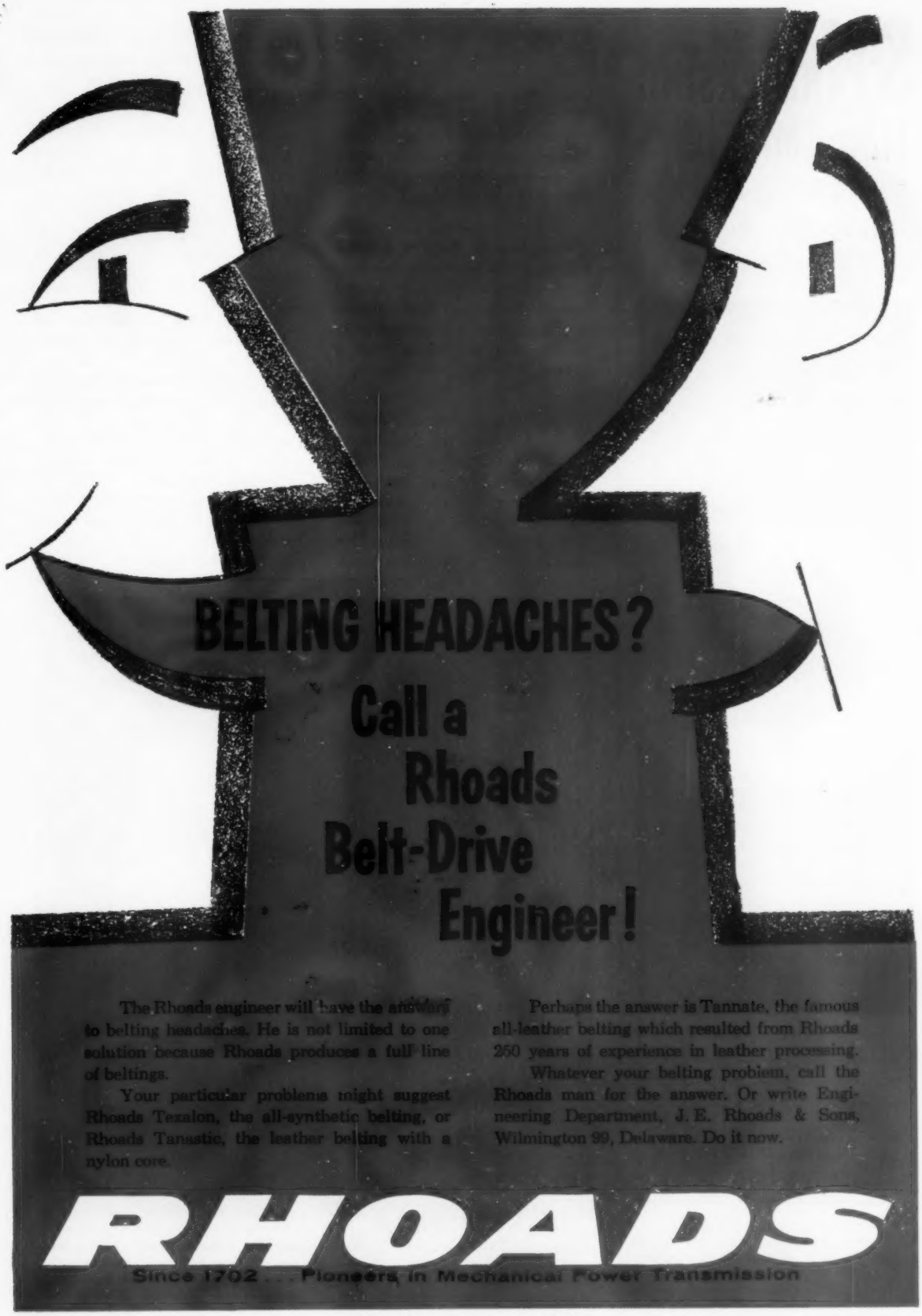
Performance of the plastic housed turbine was much improved due to reduced expansion and correspondingly reduced clearances between blades and housing which maintains higher pressures.

Giant straddle truck lifts 30 tons

One of the largest straddle trucks ever made, this Hyster carrier is capable of picking up and carrying 30-ton loads between its wheels. It's 12 ft 2 in. high, 9 ft 3 in. wide and weighs about 17 tons.

The Hyster's main job is to haul steel loads back and forth between the Timken Co.'s Canton and Gambrinus steel mills, a distance of 2¼ miles from point of pickup. It first lifts several loads of steel onto a heavy duty bolster, then picks up the bolster and carries it to its destination. During an eight-hour shift, the big truck can make 16 round trips. If it were required to carry the 30-ton load each trip, its potential load carrying capacity for the eight-hour shift would be 960 tons. Maximum bulk size is 75 in. high by 60 in. wide.

The Hyster has 16 Timken tapered roller bearings, on the pinion differential, wheels and at the tops of the fork tubes. The tires, specially designed for high traction and heavy loads, are Goodyear's 14.00 x 24, 24-ply rating Hard Rock Lug Extra Wall type. The truck has 8 shock absorbers in addition to the usual load springs.


BELTING HEADACHES?
Call a
Rhoads
Belt-Drive
Engineer!
The Rhoads engineer will have the answers to belting headaches. He is not limited to one solution because Rhoads produces a full line of beltings.
Your particular problems might suggest Rhoads Texalon, the all-synthetic belting, or Rhoads Tanastic, the leather belting with a nylon core.
Perhaps the answer is Tannate, the famous all-leather belting which resulted from Rhoads 250 years of experience in leather processing.
Whatever your belting problem, call the Rhoads man for the answer. Or write Engineering Department, J. E. Rhoads & Sons, Wilmington 99, Delaware. Do it now.
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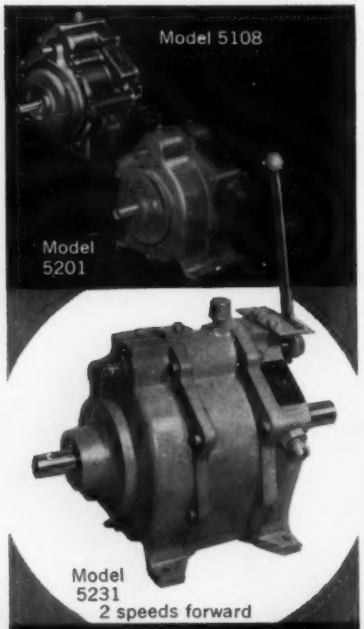
S-N REVERSING TRANSMISSIONS

5 models 8 and 28 h.p. with power packed versatility



S-N Reversing Transmissions are performance proven, space-saving single units which reverse under full load. Adaptable to the design or redesign of a wide variety of industrial equipment. For technical data write The Snow-Nabstedt Gear Corp., Hamden, Conn.

SPECIFICATIONS

Model No.		5231	5201	5108
Reduction Forward		1.97:1 3.34:1	3.16:1	3.75:1
Ratio Reverse		3.37:1	3.16:1	3.75:1
Power Up To		28 HP	28 HP	8 HP
Max. Input Torque in. lbs.		1000	1000	320
Max. Input Speed RPM		2400	2400	2400
Dimensions	Long	15 11/16"	11 1/2"	9 1/16"
	Wide	14"	13 1/2"	10"
	High	14 1/4"	14 1/4"	10 3/4"

SNOW-NABSTEDT
Industrial Division
Transmission Engineers
For Over Half a Century

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NEWS

. . . from the Soviet technical press

Recent noteworthy articles in Russian technical journals (translations available from the Office of Technical Services), dealt with:

Automatic Roller Chain Plant in Krasnodar—claimed as the world's first. Six parallel transfer lines supply finished parts to the hoppers on the assembly line. Annual production: half a million meters of roller chains.

Work Hardening of Torsion Shafts by Turning. Number of machining operations for a finished tractor torsion shaft was reduced from 12 to 7 and machining time shortened by 46 minutes. Work hardening by turning—the final machining after heat treatment—was performed with cutting tools tipped with sintered carbide (30% titanium carbide, 4% cobalt, 66% tungsten carbide). Machining was done in a single pass with depth of cut 0.5-0.7 mm, feed 0.5 mm per turn, and cutting speed 20 m/min.

Antifriction Properties of Antimony Alloyed Cast Iron. Addition of 0.25-0.35% to gray cast iron increases its hardness from 197 to 229 HB. Tests showed that the wear resistance of antimony-alloyed cast iron parts (3-3.5% carbon, 1.4-2.2% silicon, 0.6-0.8% manganese, 0.3-0.65% antimony) is two to three times as high as that of bronze and is much higher than that of gray pearlitic cast irons.

TINIEST BELT?—An inspector at the Goodyear Tire & Rubber Co.'s Lincoln, Neb., plant uses a magnifying glass to check a tiny positive drive belt for a new duplicating machine. The cogged belts, in all sizes, are simplifying engineering and manufacture of small machinery and instruments. Belts are fabricated over a "carcass" of tough fabric strands.

Zero-Max quadruples production potential

The Zero-Max Company has moved to a newly-purchased building at 2845 Harriet Ave. South Minneapolis 8. Production potential is now quadruple that possible in the old building. Stations have been installed for simultaneous run-in of 180 drives. Larger lab facilities for testing and development work have also been set up.

New section in NEMA for new power sources

Representatives of 22 leading member-companies of the National Electrical Manufacturers Association have decided to organize a new section to deal with unconventional power generation. Its scope will include magnetohydrodynamics, fuel cells, thermoelectrics, thermionics, batteries, photovoltaics, and photochemicals.

A five-man program committee, headed by Dr. Manfred Altman, consulting engineer, Missile-Space Vehicle Department, General Electric Co., will prepare recommendations for proposed Section activities. Early projects will probably deal with Government contacts and the development of standards for basic terms, definitions and tests.

It is expected that invitations will be extended, at an early date, to companies in this field to join the association and affiliate with the new section.

G. E. revises motor price policy

General Electric has revised its pricing policy for large induction motors and synchronous motors and generators. The new policy results in a range of price increases up to six per cent and price decreases of about 20 per cent across wide lines of motor ratings from 150 to 50,000 hp. The new listings have been condensed and simplified into two printed sheets, replacing the 22 pages previously required.

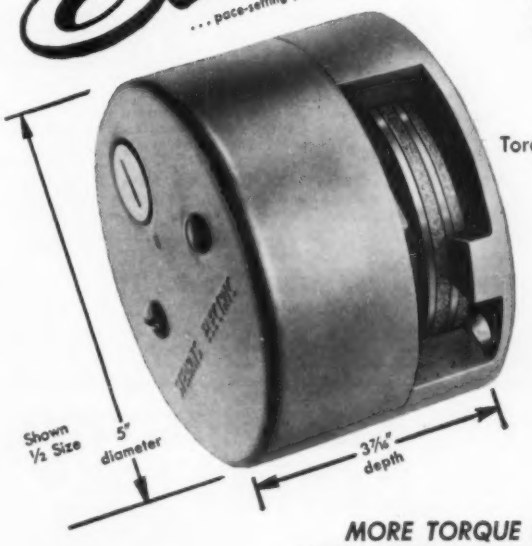
...and— another NEW product from Stearns

...pace-setting pioneer in electro-magnetic clutches—brakes—clutch-brakes

NOW AVAILABLE - NEW SIZE H-44 electro-magnetic DISC BRAKES

Prompt Shipment

Torque—3 lb-ft. max.
Weight—5½ lb



Exclusive *Stearnetic* unitized construction, and *"Visi-Wear-Indicator"*

MORE TORQUE PER POUND... MORE TORQUE PER CUBIC INCH!

THE NEW STEARNS "H-44's" are spring set—solenoid released disc brakes that mount on NEMA "C" flanges of "40 frame" fractional hp electric motors . . . provide fast, smooth, quiet stops—"failsafe" operation . . . combine higher torque with minimum size and weight.

THE NEW STEARNS "H-44's" are available for either AC or DC . . . in Standard, or Dustight-Waterproof enclosures . . . operate horizontally or vertically . . . are also available with brackets for floor mounting.

Specify THE NEW STEARNS "H-44's" with complete confidence—they have been fully life-tested, and *Installation-Proved* for long, trouble-free, dependable operational life with a minimum of maintenance.

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The Complete Line of Electromagnetic Clutches — Brakes — Clutch-Brakes
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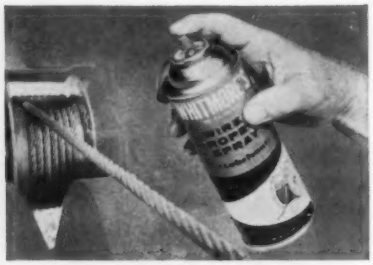
TRIAL SAMPLES

Of World-Famous WHITMORE'S Lubricants NOW IN AEROSOL SPRAY-ON CANS!



HANDI-LUBE LIQUID GEAR COMPOSITION

For open gears, sliding surfaces—exclusive formulas eliminate metal to metal contact, keep wear on the lubricant not the metal—no breakdown even after prolonged use under water—available for every climatic condition—packaged in handy 16-oz. aerosol spray-on containers or in bulk containers—send for a free trial sample.

WIRE ROPE SPRAY LUBRICANT

Exclusive formulas for lubricating and protecting wire rope, chain, springs. Penetrates to the core of wire rope minimizing internal friction and increasing usable life up to 300%—special protective qualities absolutely eliminate corrosion—non-gumming qualities reduce "carry-back"—packaged in handy 16 oz. aerosol spray-on containers or in bulk containers—send for a free trial sample.

65 YEARS OF LEADERSHIP LUBRICATING THE FOLLOWING:

- Open Gears, Dipper Sticks, Cams
- Enclosed Gear Cases
- Wire Rope and Cable
- Hydraulic Units, Torque Converters
- Roller, Ball, and Sleeve Bearings
- Speed Reducers

Est. 1893

THE WHITMORE MANUFACTURING CO.

LUBRICATING ENGINEERS

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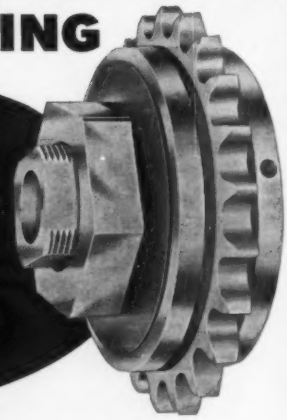
ELIMINATE BREAKDOWNS due to OVERLOADING

DALTON "OSD" OVERLOAD SAFETY DEVICE

PAT. APPLIED FOR



Ideal for use in conveyors, presses, farm machinery, construction equipment, material handling machines and applications of power transmission equipment.

- ALL STEEL CONSTRUCTION
- FEWER PARTS
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Manufacturers of
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ROLLER CHAIN

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COMING EVENTS

MARCH

11-13 American Society of Lubrication Engineers, Annual Meeting and Exhibit, Bellevue-Stratford Hotel, Philadelphia.

12-16 American Society of Mechanical Engineers, Aviation Conference, Statler Hilton Hotel, Los Angeles.

14-15 American Gear Manufacturers Association, Gear Rating Committee, Washington, D. C.

14-16 Society of Automotive Engineers, Automobile Meeting, Detroit.

20-21 American Gear Manufacturers Association, Aerospace Gearing Committee, Boston, Mass.

21-23 American Power Conference, sponsored by nine engineering societies and 14 universities, Sherman Hotel, Chicago.

20-24 American Society for Metals, Thirteenth Western Metal Exposition & Congress, Pan Pacific Auditorium, Los Angeles.

Correction—trade names

Due to an oversight, the names Helicon, Planoid and Spiroid appeared in the recently published Power Transmission Handbook and Directory with no indication that they were registered trade marks. The names Helicon, Planoid and Spiroid identify types of gears patented by Spiroid Division, Illinois Tool Works and the names are registered trade marks of this company. Also, the gears manufactured by the Spiroid Division of Illinois Tool Works are proprietary patented gears and only licensed manufacturers can manufacture or sell same without incurring liability. Through inadvertence, many manufacturers who are not licensees of Illinois Tool Works are erroneously listed as authorized to manufacture these gears.

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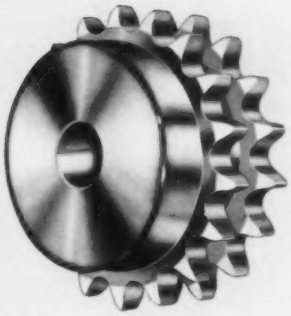

STEEL HUB SPROCKETS for single or multiple width chains, completely machined to the highest standards.

Everything in Chain Drives from A to Z

Cullman Sprockets and Roller Chains

You can be sure of meeting virtually every power transmission requirement with CULLMAN SPROCKETS AND ROLLER CHAINS—a complete selection of types and styles developed from almost 70 years' experience. Need specials? Here too, Cullman can serve you by manufacturing to your specifications. A national network of distributors and sales engineers, backed by regional warehouses, is always ready to serve you.

cullman wheel COMPANY

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GRIP-MASTER® SPROCKETS
—all steel construction, hardened teeth in pinion sizes, interchangeable hubs and bushings.

STEEL PLATE SPROCKETS
for single or multiple width chains can be supplied plain, with drilled or tapped holes, counterbored or split.

WRITE

today for free Cullman literature . . . get assistance on your power transmission problems.

FACTORY WAREHOUSES AT

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Los Angeles 21, California
2618 Carnegie Avenue,
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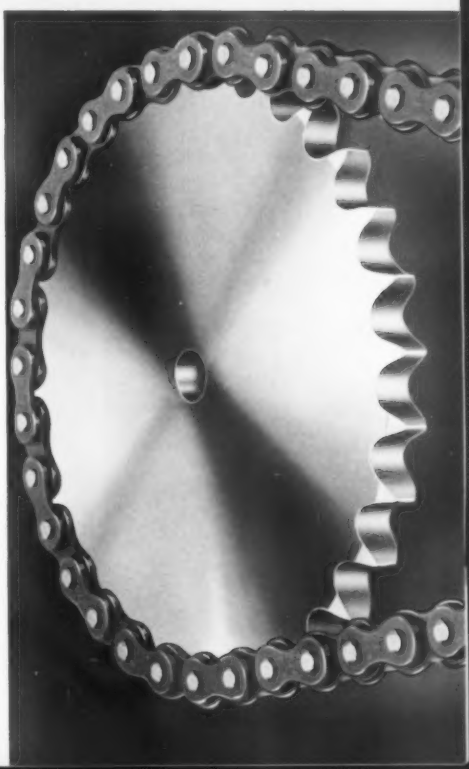
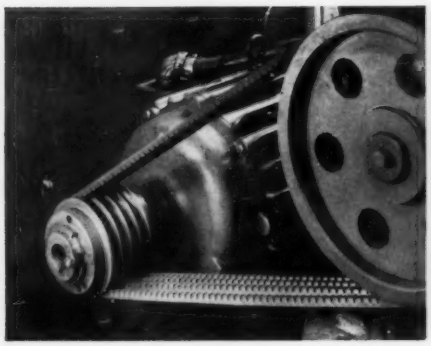
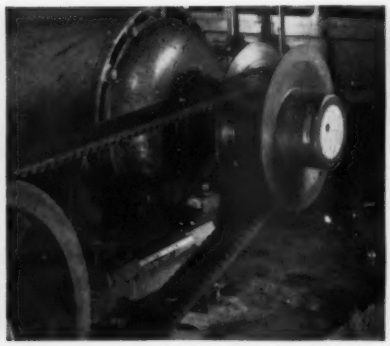
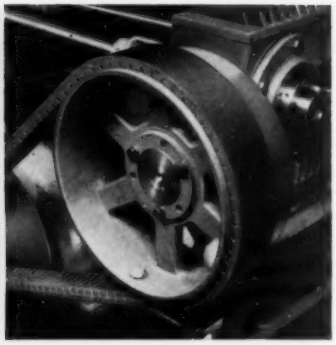
Tampa 2, Florida

Roller Chain Drives Since 1893



Wood's specialization provides the right drive to solve your belted transmission problems . . .

. . . particularly if your problems involve horsepower, high, low or variable speeds, drive efficiency, space, economy or availability.

This is because Wood's people are specialists in the production, selection and application of *all* basic types of belted drives.

We are able to provide the *right* drive for a specific application because we manufacture all of the basic types. So, drive problems can be solved by Wood's fast and economically.

To the breadth of Wood's belted power transmission line, add depth of engineering and manufacturing experience (104 years, to be specific). This depth of experience is another element of specialization that enables Wood's to offer not only unique product advantages, but consistently high performance as well.

This is Wood's stock in trade . . . supplying the *right* answers to belted power transmission problems from a broad line of Ultra-V Drives . . . Variable Speed Drives (Motion and Stationary Control) . . . Timing Belt Drives . . . Flat Belt Drives.

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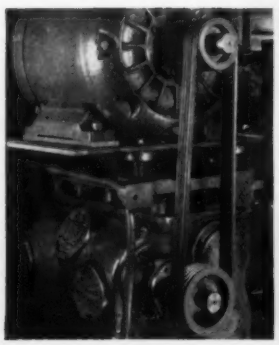
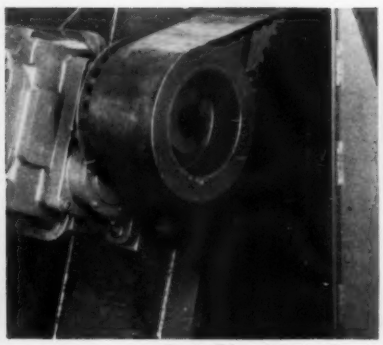
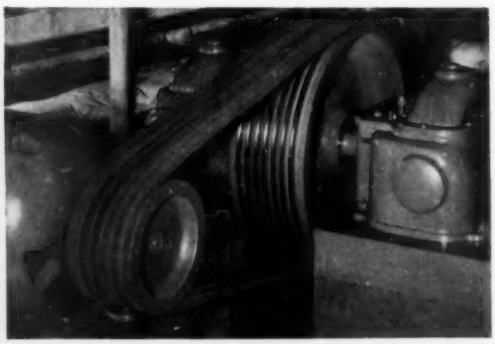

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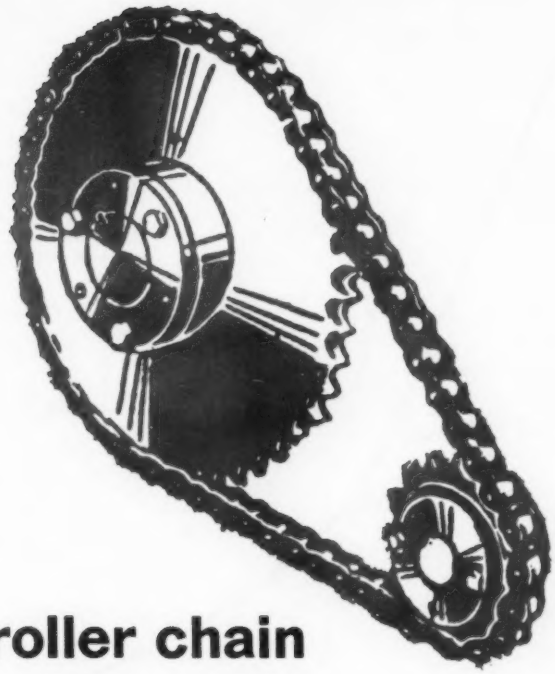
POWER TRANSMISSION DESIGN
MARCH 1961



New roller chain standards boost hp ratings

LATE LAST YEAR, the Association of Roller and Silent Chain Manufacturers submitted new horsepower ratings for American Standard roller chain to the American Standards Association. These standards represent the first real revision of roller chain ratings in nearly 30 years. The new horsepower ratings* will become a part of ASA Standard B29.1 as soon as the standard can be reprinted.

What the standard shows

In the drive selection data are service factors, Table I, and strand factors, Table II, to be used with the basic horsepower rating charts in selecting the proper size and number of chain strands for a drive. Service factors are used to compensate for characteristics of the prime mover and the nature of the application. Strand factors show how capacity increases as the number of strands is increased. Capacity is not directly proportional to the number of strands.

Real meat of the standard is in the horsepower rating charts. These are included for chains from No. 25, ¼-in. pitch to No. 240, 3-in. pitch, and are related to the number of teeth in the smaller sprocket used in the drive as well as the type of lubrication used, see Table III.

A comparison of the new and old horsepower rating charts shows two important things.

1. For a given speed and chain size, hp ratings have really jumped. This is particularly true at higher operating speeds.
2. Maximum allowable operating speeds have increased by from 50 to over 100%. Greatest increase is for medium and large sizes.

Curves in Figure 1 show speeds and hp for No. 35, ⅜-in pitch chain with a 25-tooth small sprocket.

Why the big changes

A scientific research program sponsored by the Association of Roller and Silent Chain Manufacturers produced information on capabilities of roller chain, ways to improve it, and improved lubrication techniques. Specific areas of research included:

1. Centrifugal forces from combination of speeds, sprockets, and chain pitches.
2. Critical frequency characteristics for various chain spans, speeds, sprockets, pitches, and tensions.
3. Coefficient of friction in joint articulation.
4. Conditions causing chain joint galling during

Complete copies of the new horsepower ratings are available from: The Association of Roller and Silent Chain Manufacturers, Uptown Station, P.O. Box 55247, Indianapolis 5, Indiana. Cost is $1.00 per copy.

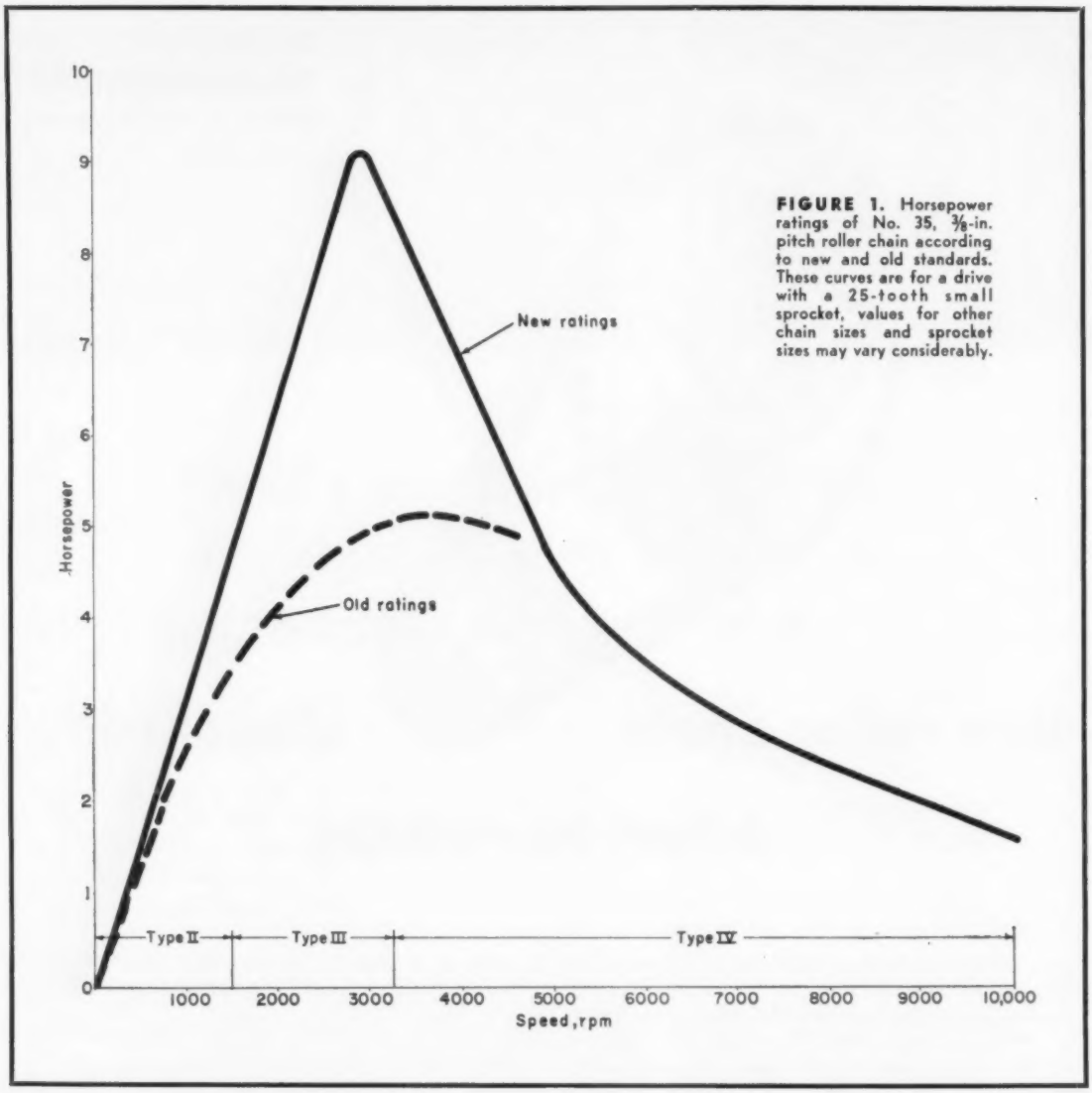


FIGURE 1. Horsepower ratings of No. 35, 3/8-in. pitch roller chain according to new and old standards. These curves are for a drive with a 25-tooth small sprocket, values for other chain sizes and sprocket sizes may vary considerably.

articulation under various lubrication conditions.

5. Horsepower formulae to predict wear life with varying speeds, loads, and lubrication conditions.
6. Link plate endurance strengths.
7. Roller impact forces.
8. Dynamic tension forces.
9. Operating efficiency.
10. Wear life of well-lubricated drives at various speeds and loads.

All of this produced the knowledge necessary to prepare the comprehensive tables of horsepower ratings which are in the new standard. Also, this knowledge pointed the way to improved lubrication techniques and chain materials.

Lubrication

The new standards recommend lubrication with oil of the viscosities shown in Table IV. Additionally, methods of application are specified and have a definite relationship to the speed and horsepower rating of the chain. Figure 1 shows which type of lubrication is recommended for the speeds and horsepowers plotted there. Types of lubrication are:

Type I—MANUAL—Oil applied periodically with a brush or spout can, preferably once every eight operating hours. Amount of oil and frequency of application should be enough to prevent discoloration of oil in chain joints.

Type II—DRIP—Oil drops are directed between link plate edges from a lubricator. Volume and frequency must prevent discoloration of oil in the chain joints. Precautions must be taken to see that drafts don't keep the oil from the proper point of application.

Type III—BATH or DISC—With bath lubrication, the lower strand runs through a sump of oil in the drive housing. Oil level should reach the pitch line of

TABLE I—SERVICE FACTORS

Driven load type	Input Power Source: Engine with hydraulic drive	Elec motor or turbine	Engine with mechanical drive
Smooth	1.0	1.0	1.2
Moderate shock	1.2	1.3	1.4
Heavy shock	1.4	1.5	1.7

TABLE II—STRAND FACTORS

No. of Strands	Strand factors
2	1.7
3	2.5
4	3.3

TABLE III—NEW HP RATING FOR SINGLE-STRAND ROLLER CHAIN—(No. 40, ½ in. Pitch)

No. of Teeth Small Spkt.	Revolutions Per Minute—Small Sprocket																		
	50	200	400	600	900	1200	1800	2400	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000	9000
	Type I Lubrication			Type II Lubrication				Type III Lubrication					Type IV Lubrication							
11	0.23	0.80	1.50	2.16	3.11	4.03	4.66	3.03	2.17	1.72	1.41	1.18	1.01	0.87	0.77	0.68	0.61	0.55	0.50	0
12	0.25	0.88	1.65	2.37	3.42	4.43	5.31	3.45	2.47	1.96	1.60	1.34	1.15	1.00	0.87	0.77	0.69	0.62	0.57	0
13	0.28	0.96	1.80	2.59	3.73	4.83	5.99	3.89	2.79	2.21	1.81	1.52	1.29	1.12	0.98	0.87	0.78	0.70	0.64	0
14	0.30	1.04	1.95	2.80	4.04	5.23	6.70	4.35	3.11	2.47	2.02	1.69	1.45	1.25	1.10	0.98	0.87	0.79	0.71	0
15	0.32	1.12	2.10	3.02	4.35	5.64	7.43	4.82	3.45	2.74	2.24	1.88	1.60	1.39	1.22	1.08	0.97	0.87	0	
16	0.35	1.20	2.25	3.24	4.66	6.04	8.18	5.31	3.80	3.02	2.47	2.07	1.77	1.53	1.34	1.19	1.07	0.96	0	
17	0.37	1.29	2.40	3.45	4.98	6.45	8.96	5.82	4.17	3.31	2.71	2.27	1.94	1.68	1.47	1.31	1.17	1.05	0	
18	0.39	1.37	2.55	3.68	5.30	6.86	9.76	6.34	4.54	3.60	2.95	2.47	2.11	1.83	1.60	1.42	1.27	1.15	0	
19	0.42	1.45	2.71	3.90	5.62	7.27	10.5	6.88	4.92	3.91	3.20	2.68	2.29	1.98	1.74	1.54	1.38	1.25	0	
20	0.44	1.53	2.86	4.12	5.94	7.69	11.1	7.43	5.31	4.22	3.45	2.89	2.47	2.14	1.88	1.67	1.49	1.34	0	
21	0.46	1.62	3.02	4.34	6.26	8.11	11.7	7.99	5.72	4.54	3.71	3.11	2.66	2.30	2.02	1.79	1.60	1.45	0	
22	0.49	1.70	3.17	4.57	6.58	8.52	12.3	8.57	6.13	4.87	3.98	3.34	2.85	2.47	2.17	1.92	1.72	0		
23	0.51	1.78	3.33	4.79	6.90	8.94	12.9	9.16	6.55	5.20	4.26	3.57	3.05	2.64	2.32	2.06	1.84	0		
24	0.54	1.87	3.48	5.02	7.23	9.36	13.5	9.76	6.99	5.54	4.54	3.80	3.25	2.81	2.47	2.19	1.96	0		
25	0.56	1.95	3.64	5.24	7.55	9.78	14.1	10.4	7.43	5.89	4.82	4.04	3.45	2.99	2.63	2.33	0			
28	0.63	2.20	4.11	5.93	8.54	11.1	15.9	12.3	8.80	6.99	5.72	4.79	4.09	3.55	3.11	2.76	0			
30	0.68	2.38	4.43	6.38	9.20	11.9	17.2	13.6	9.76	7.75	6.34	5.31	4.54	3.93	3.45	0				
32	0.73	2.55	4.75	6.85	9.86	12.8	18.4	15.0	10.8	8.54	6.99	5.86	5.00	4.33	3.80	0				
35	0.81	2.80	5.24	7.54	10.9	14.1	20.3	17.2	12.3	9.76	7.99	6.70	5.72	4.96	0					
40	0.93	3.24	6.05	8.71	12.5	16.3	23.4	21.0	15.0	11.9	9.76	8.18	6.99	0						
45	1.06	3.68	6.87	9.89	14.2	18.5	26.6	25.1	17.9	14.2	11.7	9.76	0							
50	1.18	4.12	7.70	11.1	16.0	20.7	29.8	29.4	21.0	16.7	13.6	0								
55	1.31	4.57	8.53	12.3	17.7	22.9	33.0	33.9	24.2	19.2	0									
60	1.44	5.02	9.37	13.5	19.4	25.2	36.3	38.6	27.6	0										

The limiting RPM for each lubrication type is read from the column to the right of the boundary line shown. Horsepower ratings of Multiple Strand Chains are greater than those of Single Strand Chains.

TYPE I: **Manual Lubrication.** Oil applied periodically with brush or spout can. (300 fpm max. chain speed)
TYPE II: **Drip Lubrication.** Oil applied between link plate edges from a drip lubricator. (1300 fpm max.)
TYPE III: **Oil Bath or Oil Slinger.** Oil level maintained in casing at predetermined height.(2300 fpm max.)
TYPE IV: **Oil Stream.** Oil supplied by circulating pump inside chain loop on lower span. (up to max. speed shown)

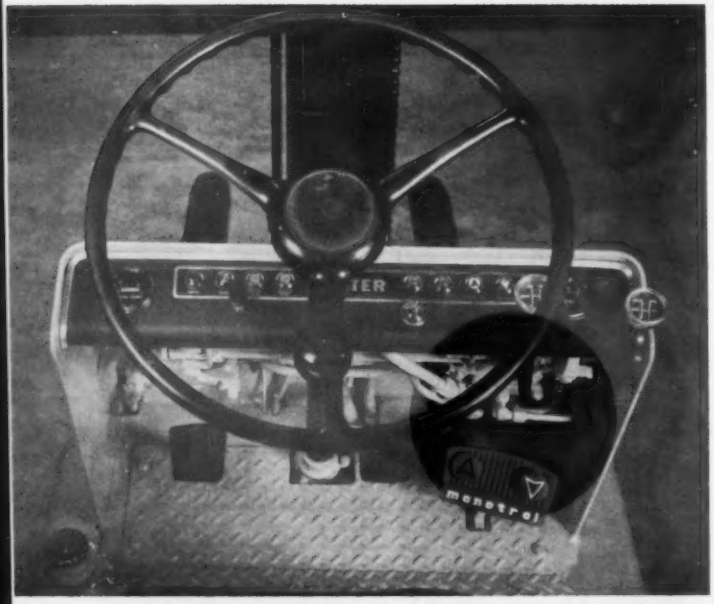
the chain at its lowest point while operating. With disc lubrication, the chain operates above the oil level. A disc picks up oil from the sump and deposits it on the chain, usually by way of a trough. Disc diameter is selected for rim speeds of 600 to 8000 fpm.

Type IV—OIL STREAM—Lubricant is usually supplied by a circulating pump giving a continuous stream of oil. Oil should be directed at the lower strand and applied evenly across the chain width.

Type IV lubrication was not a part of the earlier standard. As Figure 1 shows, this method of lubrication is specified for speeds from about 3000 rpm to the maximum. Note that this recommendation varies with chain size and the information here is for only one size chain. ◆

TABLE IV—LUBRICANT VISCOSITIES

Temp range, deg F	Lubricant Viscosity
20 - 40	SAE 20
40 - 100	SAE 30
100 - 120	SAE 40
120 - 140	SAE 50



HOW THE CONTROLS look to the operator. The 7-in. wide multi-purpose pedal at right is the key to increased safety and productivity of the truck.

Pedal for transmission control

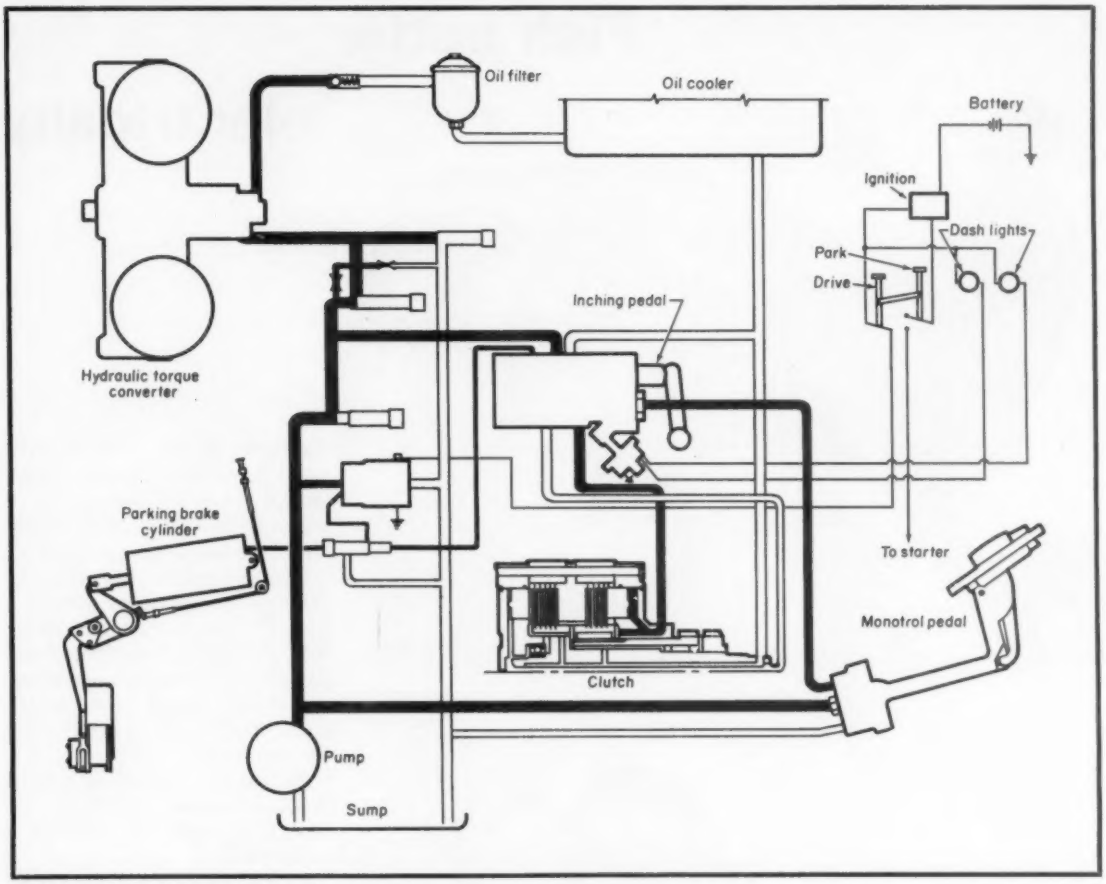
A LARGE FOOT PEDAL CONTROLS the transmission for a line of lift trucks. Forward, reverse, and speed are controlled by pressure on the pedal; there is no shift lever.

The Monotrol system of the Hyster Co., Portland, Ore., is built around their power-shift transmission. It uses a torque converter, and two hydraulically actuated clutches. One clutch is for forward movement, the other for reverse.

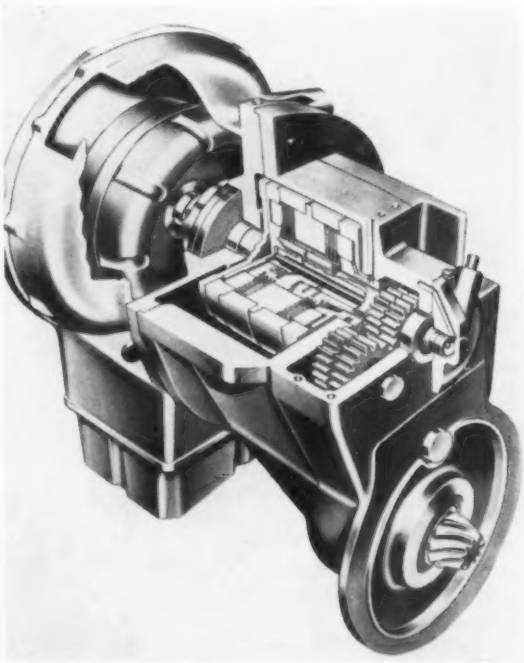
The forward-reverse spool in the main control valve is spring-loaded to the reverse position. Foot pressure on the left side of the pedal tips it 1/16-in. and opens a small valve. High pressure oil enters the spool, forcing it to the forward position. Foot pressure on the right side of the pedal causes oil to bleed from the forward-reverse spool, and the spring shifts the transmission into reverse.

Other controls are a conventional right-foot service-brake pedal, and a left-foot inching and brake pedal. Partly depressing the left inching pedal diverts some of the transmission oil through the inching spool. This reduces pressure on the forward-reverse spool, consequently reducing clutch pressure in proportion to the pedal depression.

A control memory keeps the transmission in the last-selected position. For added safety, lights on the dash-



CIRCUIT when truck is moving forward.



CUTAWAY EXPOSES THE TORQUE CONVERTER, forward and reversing clutches, and the gear drive train. Teamed with the Monotrol control system, Hyster Co.'s power shift Hystamatic transmission is available on the lift trucks of 3,000 to 5,000 lb capacity.

board indicate the direction of motion. When the right brake pedal is applied, the transmission stays in gear to give engine compression braking—the direction light is then extremely useful.

Further pressure on either side of the pedal moves it as a conventional foot throttle.

Dashboard push buttons (or the parking brake, depending on the model), control the drive hydraulically. With the engine running, pushing the park button bleeds oil from an inching spool in the main control valve. Pressure on the clutch discs is relieved, and the vehicle comes to a halt, slowly. Pushing the drive button returns pressure to the clutch. ◆

Fish better — electrically

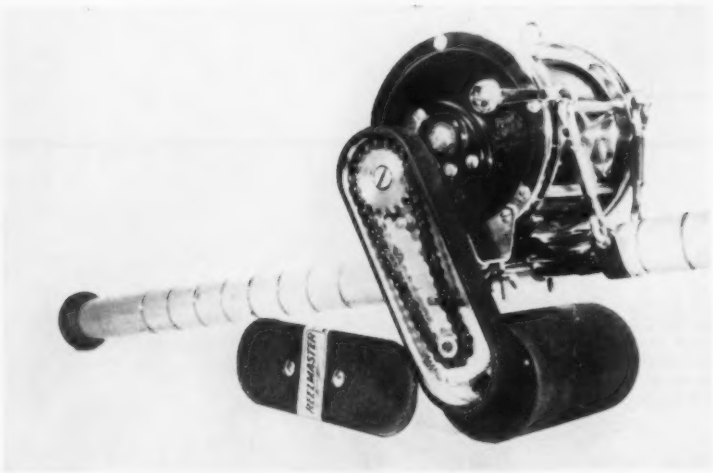
POWER DRIVES FOR FISHING REELS have more power output, extended drive life, and reduced gear costs by 75 per cent by changing from steel to plastic gears.

Reelmaster Inc., San Antonio, Tex., use the gears as part of a battery-powered, motor-driven, deep-sea fishing reel. Allen Scott, president of Reelmaster and inventor of the electric reel, needed small, lightweight gears that wouldn't wear.

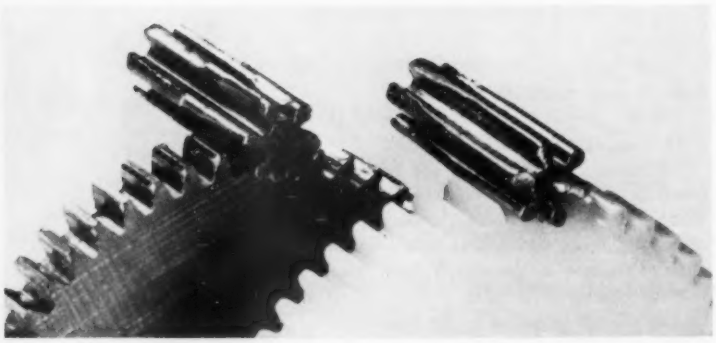
He ran a comparison test of Delrin gears and steel gears for 72 hr, under twice the full-load of actual fishing.

Results showed that the plastic gear transmitted 5 per cent more power, and wears considerably less.

Further, since machining time was cut in half, gears cost a quarter as much as the steel gears. ◆



DESIGNED FOR USE in commercial fishing, the Reelmaster incorporates a 16:1 speed reducer. High speed of the driving pinion caused it to wear very badly, until the manufacturer replaced the steel gears with plastic ones (right).



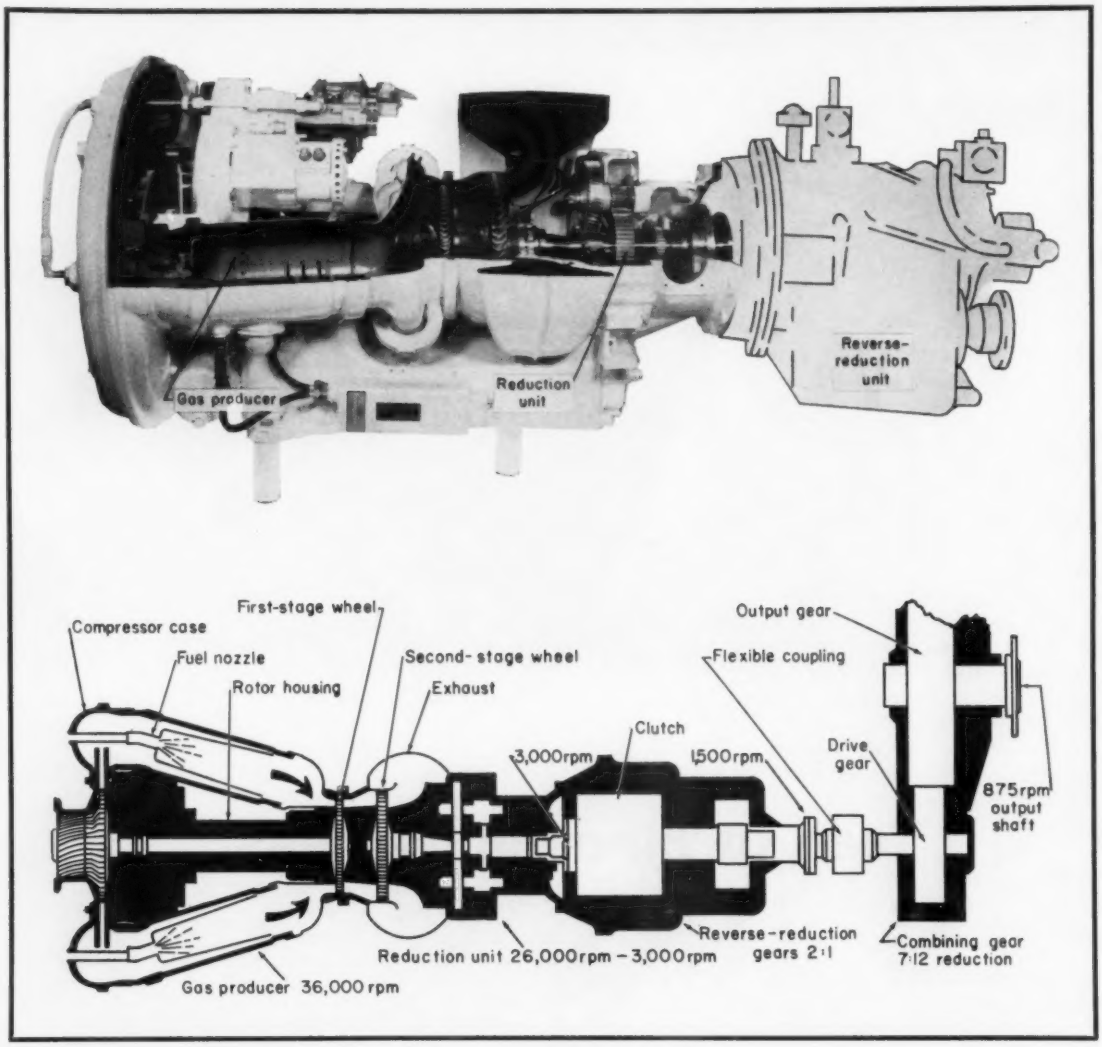
Twin turbines in harness

Why a turbine?

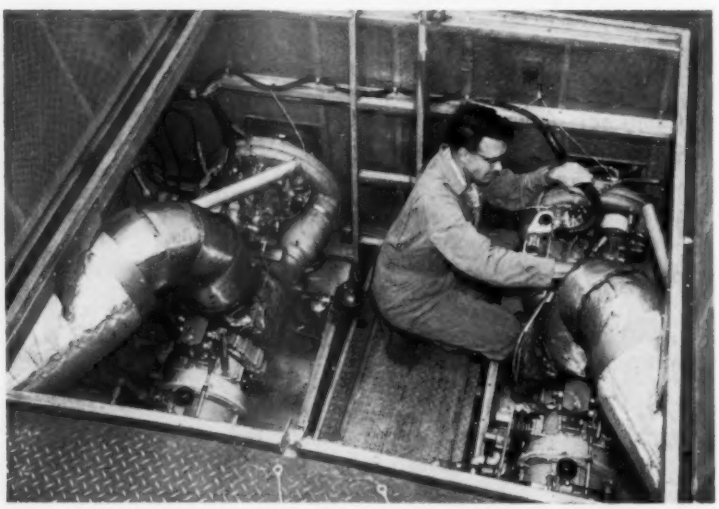
- Higher horsepower-to-weight ratio than any other propulsion unit
- Compact design needs less installation space, gives more latitude in location
- Light weight needs little supporting structure
- Overhaul and maintenance costs are low
- No vibration
- Quick starting in extreme climates—needs no warm-up
- Highest torque at stall characteristic means tremendous acceleration and towing ability

SPEED REDUCTION of about 50:1 is necessary to drive a boat from a gas turbine. The twin Turbomariners (marine drives) built by Boeing Aircraft Co., Seattle, Wash., have reduction gearing systems that can provide propellor speeds of from 500 to 2,150 rpm. The turbines themselves, simple cycle, 2-shaft, free turbines, turn at 36,000 rpm at the compressor end.

The power rotor turns at 26,000 rpm. It drives the turbine output shaft, through a countershaft reduction gear, at 3,000 rpm. In the boat, built for Creole Petroleum Corp., the two turbines output



TWO TURBINES POWER the 40-ft Creole Petroleum Corp. personnel boat, currently operating on Lake Maracaibo in Venezuela. The boat has 400 shaft hp, can cruise at 35 mph. It can be operated economically at part loads by using one turbine only, operating at full-load efficiency. Cutaway view (above) points up the compactness and simplicity of the whole power plant. Use of the reverse-reduction gearing permits full application of any power ratios from the twin turbines, from each delivering equal power, to only one operating. Thus, if one were to develop a malfunction which caused it to deliver only ½ power, the boat can fully utilize this amount.

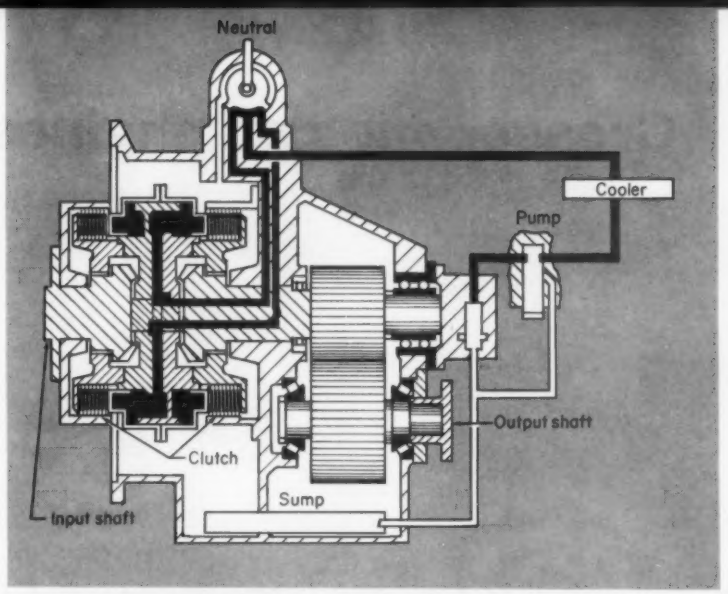


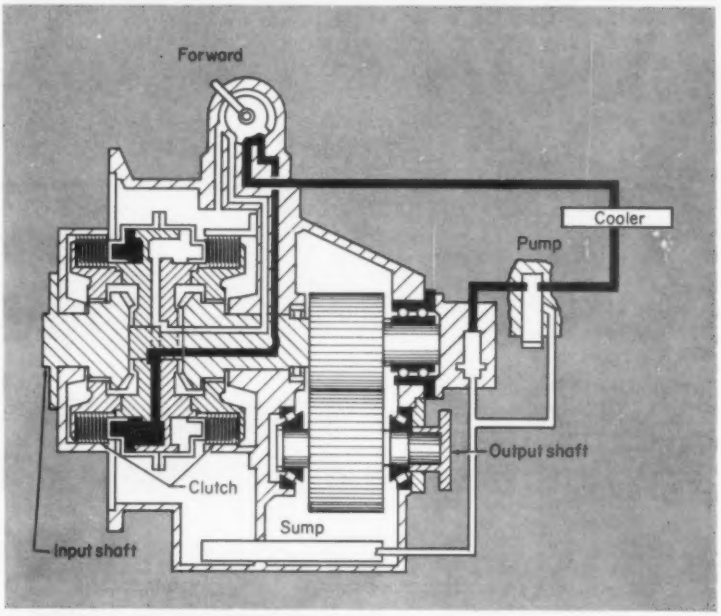
TWIN TURBINES

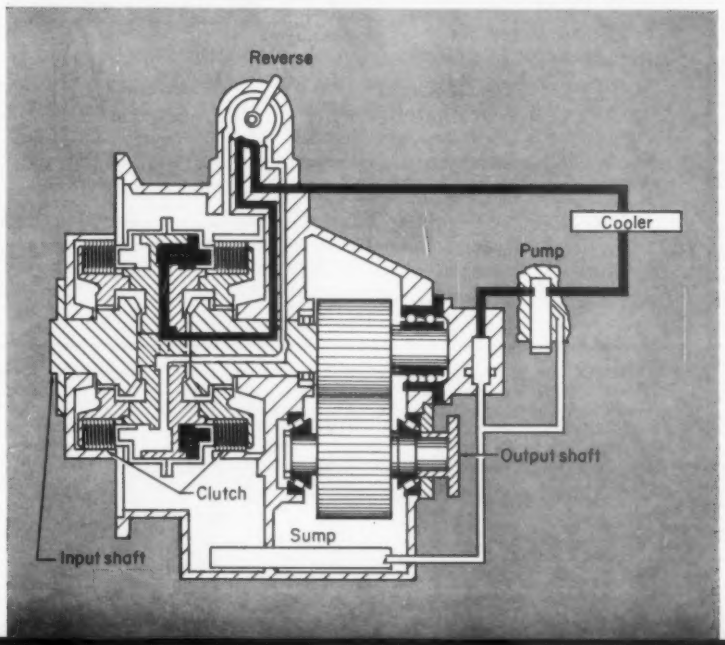
shafts then drive reverse-reduction gearboxes. They are simple to operate, and require no servicing. Movement of a single lever controls forward, reverse, and neutral, propellor positions. The lever can also be locked to the throttle control, so as to shift to forward as the throttle opens, and to neutral as it is closed. Pilot-house control would be impossible without this interlock, but in all cases, it is recommended for prolonging the clutch-life.

Since there is no mechanical connection between the compressor and the power turbine rotors, the effect is that of a built-in torque converter. On tight turns, or with the propellor out of water, the power rotor (and hence the propellor), turn at constant speed—despite the radically changed power consumption during these periods.

Separation of the compressor from the power turbines gives the craft excellent acceleration. When the throttle is moved to full ahead, the governor on the power turbine demands full power from the compressor and the engine immediately develops maximum torque. ◆





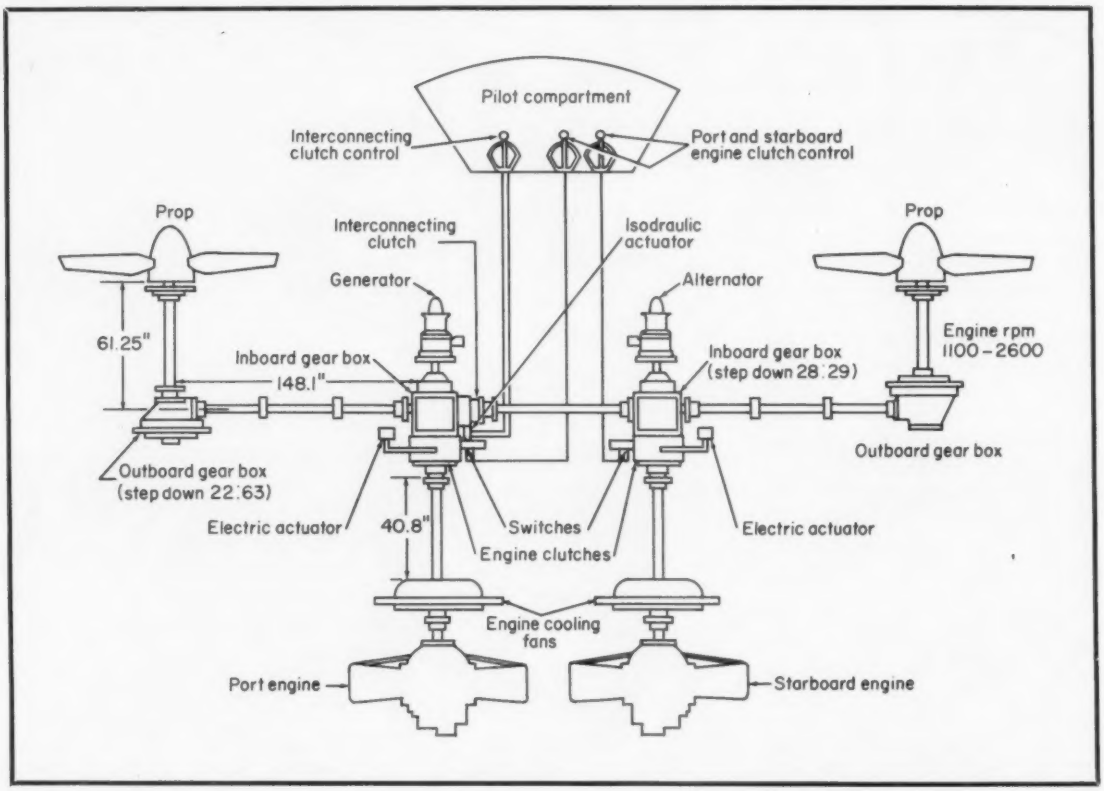


REVERSE-REDUCTION GEAR UNIT serves a triple purpose. It permits the propellor to be disengaged from the engine; allows reversal of the propellor without change of engine speed or direction; and it increases propellor efficiency by permitting the best speeds to be selected for both engine and propellor. The heavy black line indicates the path of the hydraulic fluid for forward, neutral and reverse, in the patented unit.

Crossconnected engines drive blimp

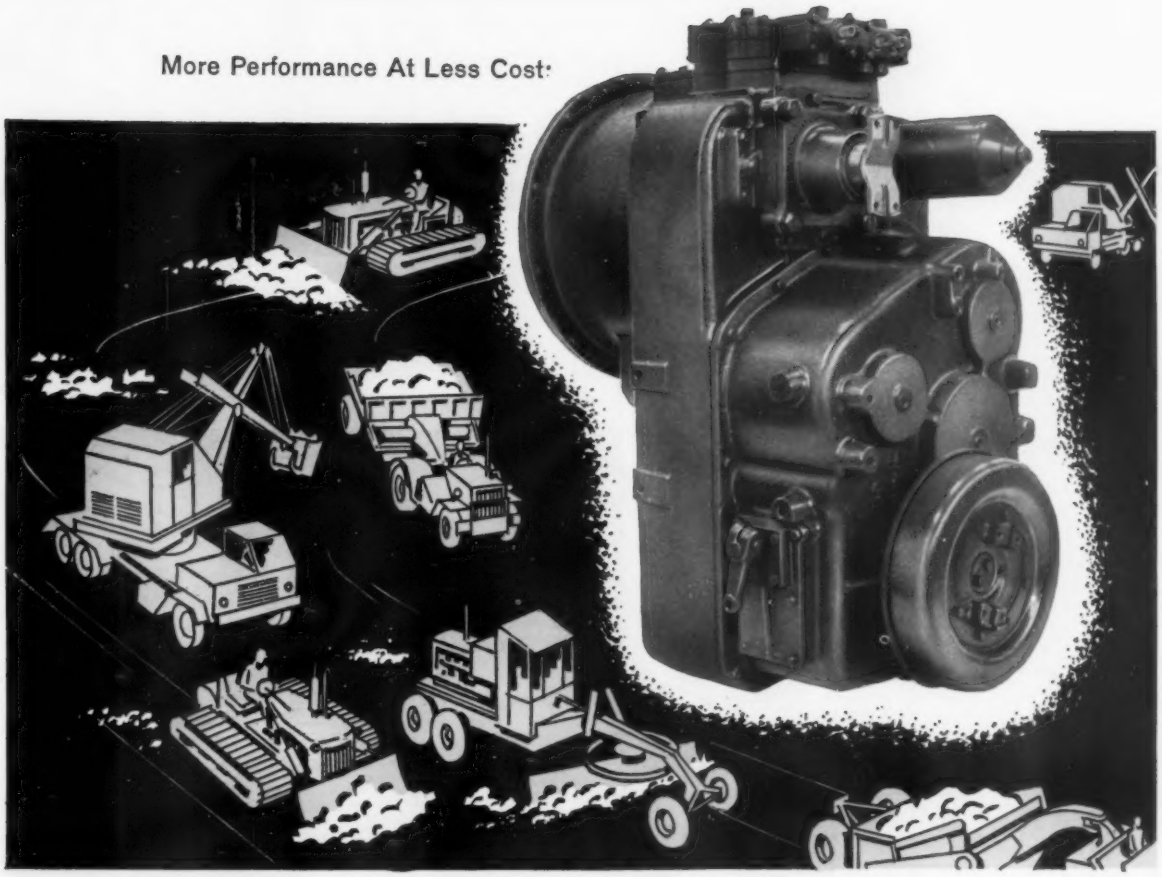
AN INVALUABLE LINK in our aircraft early warning defense system, the Goodyear ZPG-2W needed extra safety in its propulsion system.

Its two engines are crossconnected so that, in the event of failure of either of them, the remaining one could propel the ship home without hardship. For long-time station-keeping, only one engine is used, to maintain steerage with maximum possible fuel economy. For maneuvering purposes, either propellor can be disconnected for swift turns. The crossconnection makes use of three clutches, and 24-ft of transmission shafting. ◆



FOR STABILITY and routine in-flight maintenance, the engines are mounted directly under the gas bag, at the aft end of the crew cabin. Bringing them inside, however, meant providing large cooling fans. These are mounted directly on the main engine shafts. Still within the cabin space, forward of the engines, inboard gearboxes and engine clutches are mounted. Connecting the gearboxes is a third clutched shaft, controlled from the pilot compartment. Outriggers on which the propellors are mounted necessitate twelve feet of drive shaft from each inboard gearbox to its outboard gearbox. To reduce the weight of these long shafts, the outboard gearboxes are also speed reducers, with a ratio of 63:22.

More Performance At Less Cost·



HYDRA-DRIVES®
CDB POWER SHIFT TRANSMISSION

A torque converter...and 4-speed transmission in one compact package!

Proved in hundreds of vehicles for four years, these units assure top work output of heavy-duty equipment . . . at a lower initial cost than other models of comparable performance. Engine lugging and heavy shock loads are eliminated. A 3 to 1 torque multiplication makes starting fast and effortless—even with heaviest loads.

Just a flip of the operator's lever accomplishes power shifts within each range and without any interruption of the power flow.

With four speeds forward and reverse, the CDB Hydra-Drives Power Shift Transmission is ideally suited for vehicles which must travel in both directions during a normal work cycle. Rated at 550 ft. lbs. input torque, it can be used with a wide range of internal combustion engines up to 250 H.P.

The CDB model illustrated above is used in connection with a size "C" drop box.

A BDB model is also available, for use with a size "B" drop box on equipment up to 175 H.P.

Another Product of... **ROCKWELL-STANDARD CORPORATION**

ROCKWELL R STANDARD

Transmission and Axle Division, Detroit 32, Michigan

Circle **35** on Reader Service Card

No planets for earthmover transmission

A COUNTERSHAFT POWER-SHIFT TRANSMISSION has been designed by LeTourneau-Westinghouse Corp., Peoria, Ill., for its heavy-duty earthmoving equipment.

Countershaft design is ideal for the simple, but rugged, work of earthmoving. It is cheaper and easier to make than a planetary transmission. It makes wide variations of transmission ratios easily, with a minimum of time and cost.

LeTourneau's transmission is designed for engines in the 400- to 650-hp range. It has very fast clutch engagement—complete shifts can be made in 0.6-secs—and there is no clutch overlap. Shift shock that marks some planetaries is avoided. This means extra life for the gear train. Disc clutches with sintered bronze friction faces and oil-cooling, mean long clutch life.

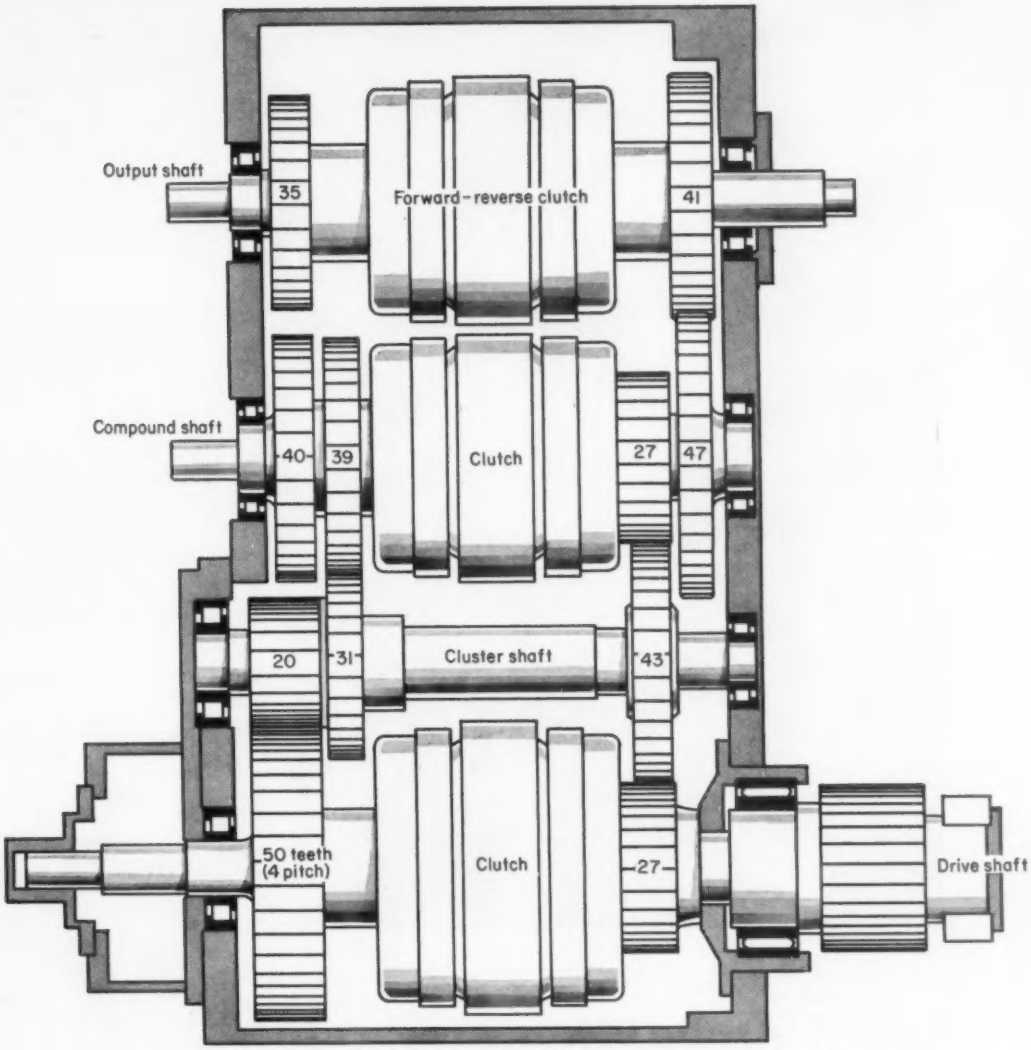
The transmission uses a pressure mist-oil system, of SAE-10 oil. None of the parts move in an oil bath. This design keeps the transmission friction low and the cooling rates high.

Torque converter and transmission have separate oil systems, so that a splitter transmission can be used without radically redesigning the system. When a torque converter is used, it is mounted amidships.

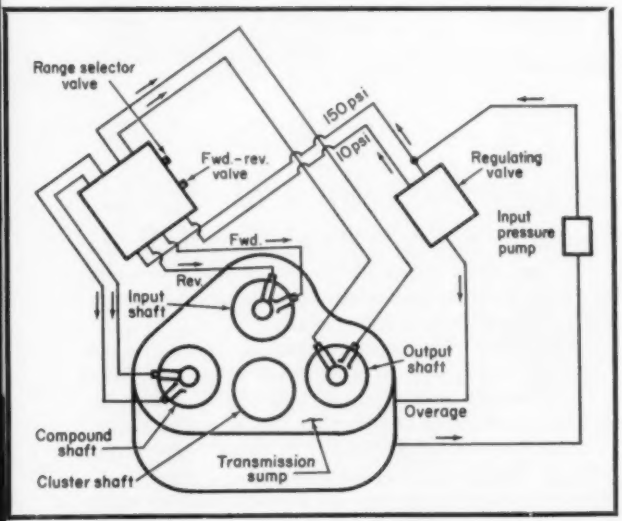
An automatic clutch-lock increases efficiency at high speeds, and a hydraulic dynamic brake is incorporated that uses engine compression to make the service brakes last longer.

The transmission usually is mounted on the rear case of the earthmover, for ease of removal. In this case, the power flow is over and back. But the input shaft can be assembled into the transmission in the reverse position, so that a straight-through power flow is provided. This arrangement is used when the transmission is to be installed amidships. No new parts are used for the straight-through arrangement.

Once the transmission is installed, no further adjustment or maintenance is required. To remove the rear-mounted transmission—remove a single ring of bolts, pull two clevis pins and disconnect a hose. ◆



POWER INPUT SHAFT is connected with the compound, output, and cluster shafts through a simple gear train. Rotation of each shaft is controlled with very little operator effort, through a hydraulically-actuated disc clutch. Engagement of any driven shaft is smooth, does not cause excessive strains in the gear teeth. By removing the face plate, LeTourneau-Westinghouse can vary the transmission ratios very easily to suit special circumstances. Unusual section shows some gears not meshed, which actually are.



HYDRAULICS SCHEMATIC explains why maintenance and running adjustments are never required. The whole system is simple and rugged.

Ideal power transmission for deck machinery

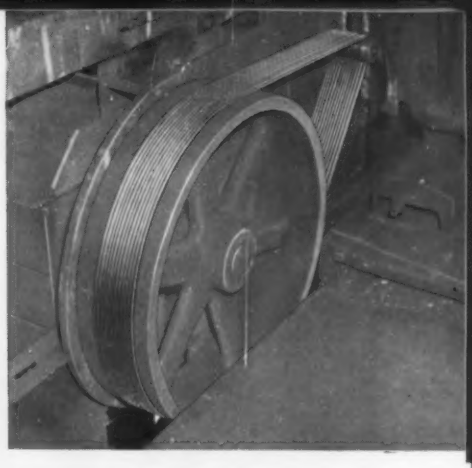
By **M. G. PFEIFER,** *Servo Section Chief, Marine and Ordnance Dept., Vickers Inc.*

Abstract of a Society of Naval Architects and Marine Engineers Paper.

SHIP CARGO HANDLING SYSTEMS comprise a winch, driven through a transmission by a motor, and motor controls. An ideal system is a hydraulic transmission, a constant speed ac motor, electrohydraulic controls, and a mechanical winch.

No one today questions the mechanical winch and the ac motor. The discussion will prove the superiority of a hydraulic transmission system.

A variable displacement pump is driven by an ac motor. The pump, in turn, drives a fixed displacement hydraulic motor that, through gearing, drives the winch. Direction of flow through the pump determines whether the winch will "lower" or "hoist." The direction of flow, in turn, is determined by a signal from the control panel through an electrohydraulic valve.



GATES SUPER HC DESIGN ELIMINATES SPEED REDUCER

...saves $500

The 20" x 40" single-roll crusher shown above is used by the Middle Pennsylvania Coal Corp., Madera, Pennsylvania, for the primary crushing of bituminous coal.

Originally, because of space limitations with a conventional V-belt drive, a speed reducer was required in lowering the 1800 rpm motor speed to 140 rpm for the crusher.

In designing the drive for this crusher, C. W. Davis, president of the coal company, was assisted by the Gates Field Engineer for the mid-Pennsylvania area.

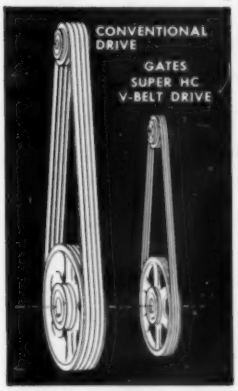
They found that by using a compact Gates Super High Capacity V-Belt Drive, a direct reduction of speed could be accomplished, eliminating the speed reducer. At their request, the crusher manufacturer grooved the 36" flywheel to handle Super HC Belts instead of conventional B-section belts.

Mr. Davis tells us, "By using the Gates Super High Capacity V-Belt Drive, we were able to save about $500 on the installation."

Your nearby Gates Field Engineer is an experienced, fully-qualified drive design expert. To contact him for help in designing a new drive, or for quick delivery of replacement V-belts, call your nearby Gates Distributor.

Designing a new drive?

Gates Super HC High Capacity V-Belts save drive space, weight, money



If you are designing a new drive, or if the belts and sheaves of a conventional V-belt drive must be replaced, you will benefit many ways by installing a Gates Super High Capacity V-Belt Drive.

Gates Super HC V-Belt unites new, high performance materials with a basic change in the shape of the belt itself. Because of this, it is able to handle up to 3 times the horsepower of a conventional V-belt in the same space . . . cut drive costs as much as 20% . . . and reduce drive weight 20% and more. Guards can be smaller. Bearing loads are less, increasing bearing life. And the drive can operate at belt speeds up to 6000 ft/min without dynamic balancing!

Need replacement V-Belts?

Longer belt life makes Gates Hi-Power V-Belts industry's No. 1 choice

• **Concave Sidewalls** (U.S. Pat. No. 1813698)—It is easy to see why Gates Hi-Power V-Belts give far longer belt life than ordinary V-belts. *Just make this simple test:* Bend a Gates V-Belt as if it were going around a sheave. Feel how the concave sides (Fig. 1—A) fill out . . . become perfectly straight (Fig. 2—A) to make full contact with the sides of a sheave. The belt thus grips the sheave evenly and distributes wear uniformly across the sides of the belt, lengthening belt life.

• **Precisely-Engineered Arched Top**—The arched top (Fig. 1—B) of the Gates Hi-Power V-Belt prevents any distortion of the tensile section cords as the belt bends around the sheave. The load is uniformly distributed with each cord carrying its full share.

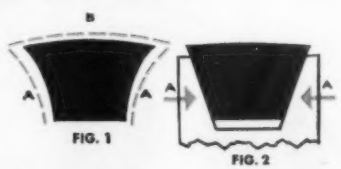


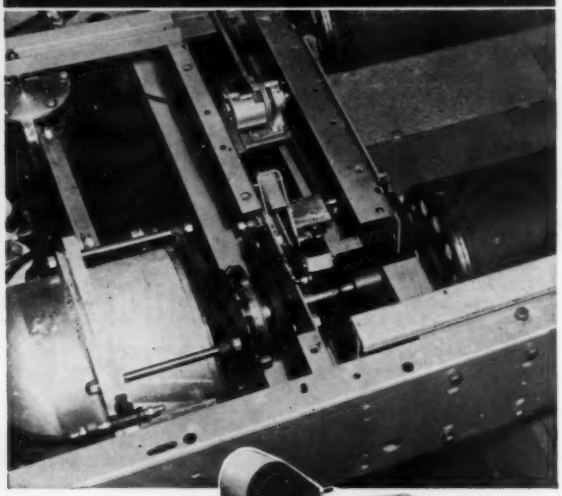
FIG. 1 FIG. 2

Building the future on 50 years of progress

The Gates Rubber Co.
DENVER, COLORADO

BP-8

Sier-Bath Couplings Help Clayton "BUILD ROADS IN MINUTES"



Clayton dynamometers, "the world's most widely used", can simulate any road condition in a matter of minutes and completely road test your car without leaving the corner garage.

Standard Sier-Bath flexible couplings are specified on every chassis model dynamometer made by the Clayton Manufacturing Company of El Monte, Calif. and Cincinnati, Ohio. Their complete line of "Turbo-Closed System" dynamometers are world famous for controllability, smoothness of operation and long service life.

Clayton needed a strong coupling to take the stop-start-and reversing torques inherent to this application, but the coupling had to be small and compact due to space limitations.

Sier-Bath's unique one-piece sleeve design provides the strength Clayton requires and it also eliminates the extra bulk and weight associated with split-sleeve coupling designs which must be bolted together.

These product advantages will add to your next design when you specify Sier-Bath flexible couplings.

Get complete engineering information on both standard and special Sier-Bath flexible couplings . . .

Send For Your Catalog Today.

Sier-Bath
GEAR AND PUMP CO., INC.
FLEXIBLE COUPLING DIVISION
9252 HUDSON BLVD., NORTH BERGEN, N. J.
Member A.G.M.A.
Founded 1905

Circle **37** on Reader Service Card

The valve directs fluid to the stroke cylinder of the variable-stroke pump.

The control cycle is completed by feeding back the stroke cylinder position information to neutralize the control valve signal when the commanded pump output is reached. Thus, speed and direction of the winch rotation are controlled by the pump stroke. The ac motor and pump never change direction or speed.

Two relief valves prevent the main hydraulic system from being subjected to greater-than-design pressures. Pressure on the main hydraulic lines becomes strictly a function of winch load. Consequently, a horsepower limiter provides protection for the ac motor, booms, and rigging, from overloads on the hook, and from sudden load accelerations. It maintains positive control of the load up to the point of relief valve setting. The load cannot fall.

DESIRED FEATURES OF A CARGO WINCH DRIVE.

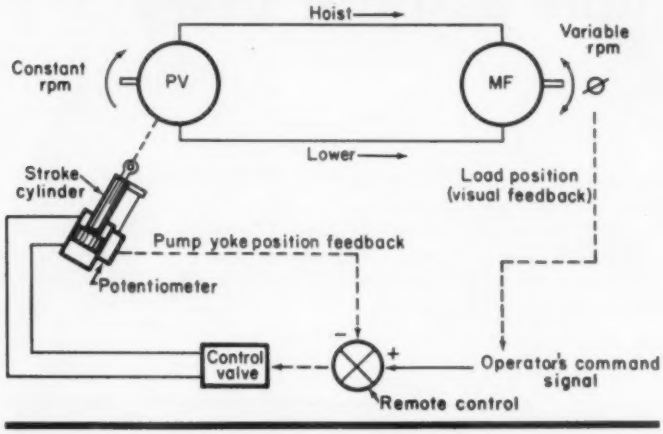
- *True fingertip stepless speed control*
- *Infinitely variable speeds*
- *Optimum creep-speed characteristics*
- *Fail-safe operation*
- *Inherent load and equipment protection*
- *Broad range of available horsepower*
- *Light weight and compact envelope*
- *Inherently reliable and rugged*
- *Minimum maintenance*
- *Man-proof operating and performance characteristics*
- *High efficiency*

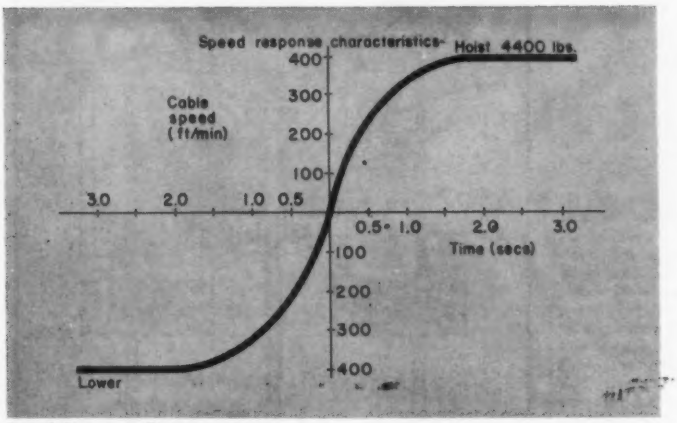
When the product of hoist line pressure and pump flow equals the design horsepower limit for the electric motor, the hp-limiter takes over. It automatically reduces the pump stroke, which in turn reduces cable speed.

A brake valve is provided, that sets and releases the brake. When the pump goes into neutral, the valve is de-energized, and the spring-loaded brake locks on the winch.

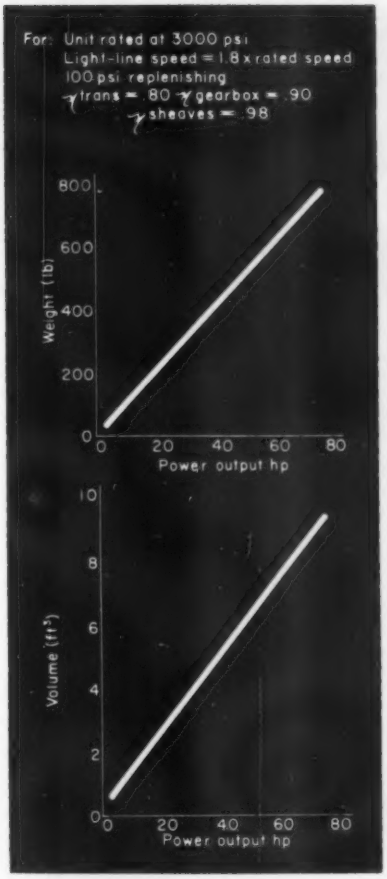
The entire transmission and control is very rugged and very simple. It is easily maintained, and easily operated. The transmission has an inherently fast response.

THE ADVANTAGES of the Ideal winch system can be summed up by two illustrations: compact (top), and simple (bottom).





Speed Response Curve



THE HP-WEIGHT and hp-volume ratios of hydraulic equipment are far lower than those of other commercially acceptable equipment. The curves include weight and volume of all auxiliary equipment, such as pumps, valves, piping, and so on. A 75-hp hydraulic transmission weighs about 800-lb—no other type of equipment can approach this low weight. The same 75-hp transmission occupies approximately 9-cu ft. The savings resulting from use of hydraulic transmissions can, of course, be turned to profit, by adding the equivalent amount to the useful cargo.

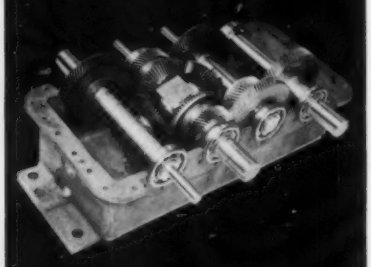
The control has a large stability margin, and offers an infinite range of speed control. It is extremely accurate.

Advantages of the low-inertia characteristics of a hydraulic transmission are not always fully realized. Fast acceleration, deceleration, and speed reversal can be achieved (see graph of speed response). This leads to cost savings for shop operators, as low inertia means low current drain during speed changes of the winch.

A further consideration, stemming from the low volume of the transmission, is that far more deck space is available for maneuvering cargo. ◆

SPECON

DIFFERENTIAL GEAR BOXES



Differential assemblies precision crafted by Specon for drives and transmissions are available as gear boxes alone. These task-proven assemblies offer the built-in advantages of Specon units: extreme accuracy, low maintenance, rugged, space saving construction. Seven basic models are rated from 1 hp. to 75 hp. Specials and units for higher power can be supplied. The Specon units are particularly well suited for such applications as phase and register control, speed control, torque dividing, overriding, cycling and balancing operations.

For full information on Specon gear boxes, drives and transmissions, write to:

STRATOS®

A DIVISION OF FAIRCHILD ENGINE AND AIRPLANE CORPORATION
Industrial Products Branch
Route 109, West Babylon, L. I., New York

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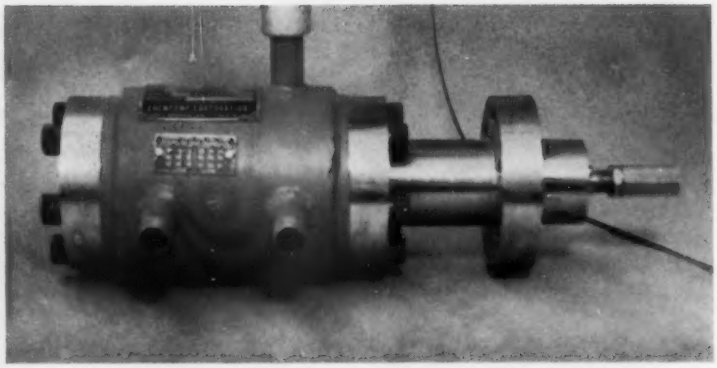
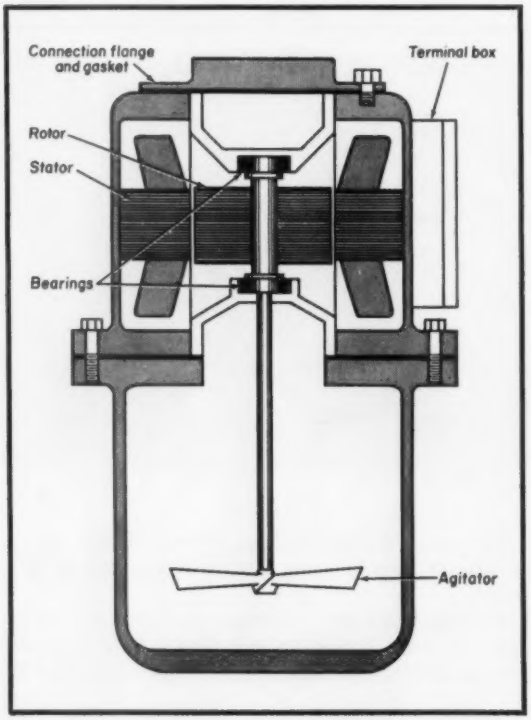


Simple agitator drive

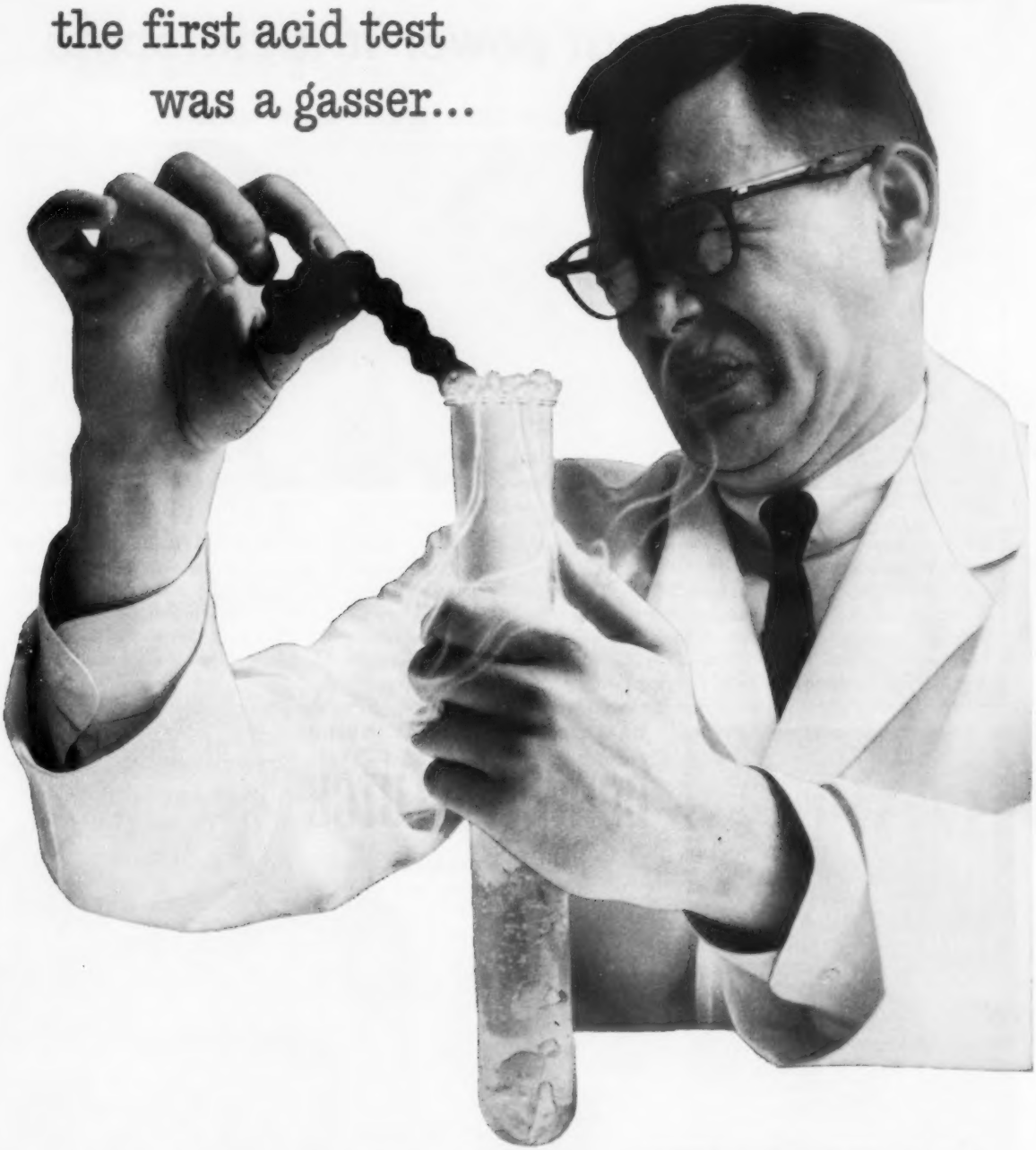
A WELL-KNOWN COMPANY is trying—very deliberately— to put power transmission designers out of work.

Their newest idea, adding to the established Chempump line, is a vessel agitator (without power transmission design problems, of course). The agitator-motor combination is made with a connecting flange and gasket, for bolting directly to a pressure vessel. ◆



NO ROTARY SEALS are used in an agitator produced by Pressure Products Industries, Inc., Hatboro, Pa. The ¾-hp stainless steel motor turns at 3450 rpm, driving an agitator which is directly attached to the motor's impellor shaft. It is designed for zero leakage under high pressures.

the first acid test was a gasser...



The first acid test choked us up and confirmed that acid is tough on any roller chain.

But the final "acid" test—the user test for strength and wear life—told us you can't find a better roller chain than Rex. The reason, of course, is Rex quality materials, modern heat-treat techniques, and precision construction. Ask any user.

Ask your Rex Distributor or District Sales Engineer for the Rex Quality Story. CHAIN Belt Company, 4691 W. Greenfield Ave., Milwaukee 1, Wis. In Canada: CHAIN Belt (Canada) Ltd., Toronto and Montreal.

REX®

CHAIN BELT COMPANY

REX IS BEST . . . IN THE USER TEST

Circle 9 on Reader Service Card

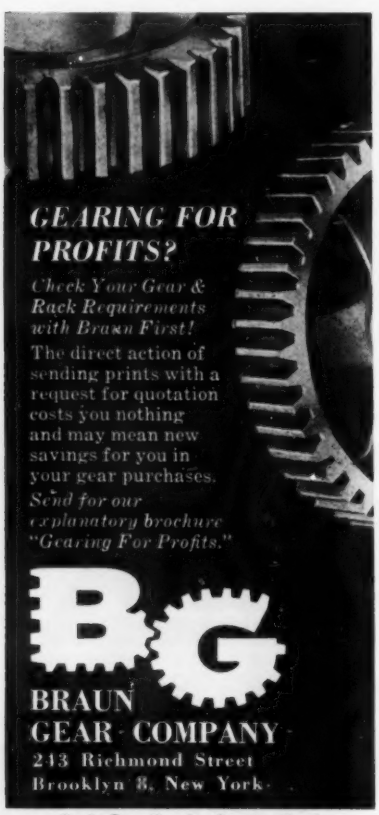
IDEAS

U-joints put power in tight spots

ENGINEERS AT THE PORT of New York Authority solved an unusual problem in power transmission with ingenuity and economy.

On one of the larger bridges for which the Authority is responsible, some almost inaccessible slots in a ⅞-inch plate had to be lengthened by about an inch. They could be reached only through a 2½-in. wide opening. Due to the proximity of certain moving parts, burning was impractical.

Power sufficient to remove the unwanted metal had to be brought to the end of the slot. The engineers fastened a reciprocating hacksaw tool to a guide track running around the slot, and supplied power through a ⅜ in. drive shaft. The power unit was a ⅜-in. light duty drill; the 42-in.-long drive shaft included two universal joints. ◆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Check Your Gear & Rack Requirements with Braun First!
The direct action of sending prints with a request for quotation costs you nothing and may mean new savings for you in your gear purchases.
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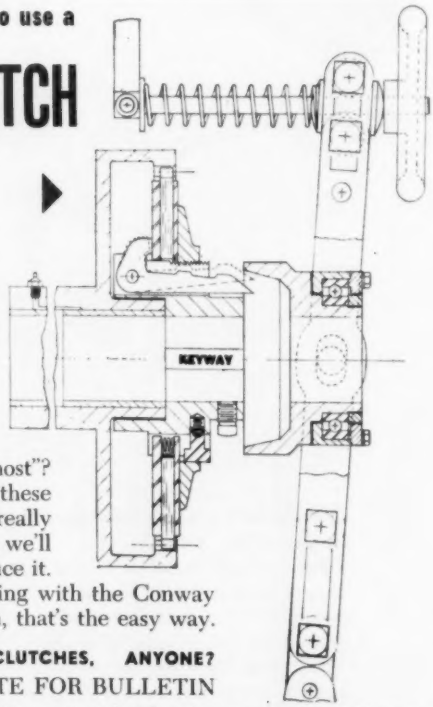
Circle 8 on Reader Service Card

What some folks won't do to use a

CONWAY CLUTCH



Just take a gander at that contraption over that-a-way. Looks like a genuine vintage Rube Goldberg. What's it for? Shucks, can't you tell? This, friends, is a Conway Variable Torque Clutch Mechanism. Turn the wheel to the right—torque increases. Turn left and torque decreases. Now, isn't that the "most"? We hate to make these (confidentially, we really love it) and if you insist, we'll force ourselves to produce it. And, you can do the same thing with the Conway *Stationaire*. But then, that's the easy way.

*SLIP CLUTCHES, ANYONE?
WRITE FOR BULLETIN

The World's Most Respected Name in Clutches for over a Half-Century

The CONWAY CLUTCH COMPANY
2754 Colerain Ave. CINCINNATI 25, OHIO

Circle 10 on Reader Service Card

TERRIFIC!

— and how long will the flexing member last?

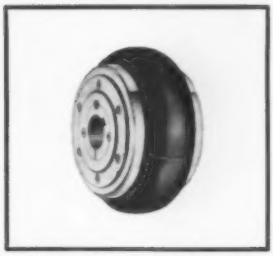
Good question. The heart of Para-flex is a tire with synthetic tension members bonded together in rubber—which provides a flexing body that automatically compensates for *all combinations* of misalignment and end float, and absorbs vibration as well!

This amazing coupling has now been used in American industry 4 years. Thousands are in operation—in steel mills, paper mills, oil fields, mines, quarries, chemical plants, everywhere—and in these 4 years, replacements of elements have been negligible.

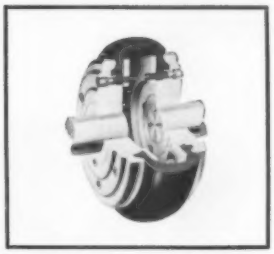
Dodge Standard Para-flex takes angular misalignment up to 4°, parallel misalignment up to ⅛″ and end float up to 5/16″ depending upon the size of the coupling and the duration of shaft displacement.

Dodge Para-flex is available in 3 types—Standard, Flywheel and High Speed (shown at right). The Standard type is stocked in capacities up to 3640 hp at 910 rpm. Ask your Dodge Distributor, or write us for complete technical bulletin.

Dodge Manufacturing Corporation, 8200 Union Street, Mishawaka, Indiana



The new idea in flexible cushion couplings, with a flexing member that "swallows up" misalignment.



No lubrication, no maintenance. Replace flexing element without moving driver or driven machine.

Flywheel and High Speed Types. For use with motors and internal combustion engines turning up to 5230 rpm.

The Products with the Pluses . . .

DODGE

of Mishawaka, Ind.

DODGE
Para-flex
CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge he can give you valuable assistance on new cost-saving methods.

Circle **16** on Reader Service Card

OIL SEALS
in Design Engineering

Garlock KLOZURE* Oil Seals stop oil leakage at bearings, increase efficiency of Denison Variable-Volume Hydraulic Pumps.

Denison designs hydraulic pumps around Garlock KLOZURE Oil Seals to assure maximum sealing efficiency.

Where pressures are too high for ordinary lip seals, KLOZURE Oil Seals prevent leakage of hydraulic oil and protect vital bearings as temperatures reach 150°F, pressures rise to 35 p.s.i., and shafts whirl at 1800 r.p.m. In use for the last twelve years, the seals have given complete satisfaction on the well-known line of axial piston and vane-type pumps made by Denison Engineering Division of American Brake Shoe Company.

Wherever bearings must have the best protection, Garlock KLOZURE Oil Seals are specified. On pumps like Denison . . . in steel mills . . . on power shovels and lift trucks . . . for motors, KLOZURE Oil Seals prevent leakage of lubrication, seal out harmful foreign matter. Whatever the application, there is KLOZURE Oil Seal to do the job. They are oil and grease resistant, impervious to mild acids and alkalies, non-abrasive, and will withstand temperatures from −40°F to +250°F. For extreme conditions, Garlock furnishes sealing elements resistant to practically any fluid, and serviceable as high as +500°F.

Availability is another prime reason for selecting Garlock KLOZURE Oil Seals. Once your design is finalized, you may select the proper seal from over 1800 stock models available from 180 national bearing distributors, including one near you.

It makes good sense to design with KLOZURE Oil Seals, as Denison and hundreds of other leading companies have found. See how you can benefit—call in your local Garlock representative. You will find him at the nearest of the 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-181. Garlock Inc., Palmyra, N. Y.

GARLOCK

Canadian Div.: Garlock of Canada Ltd.

Plastics Div.: United States Gasket Company.

Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastics Products.

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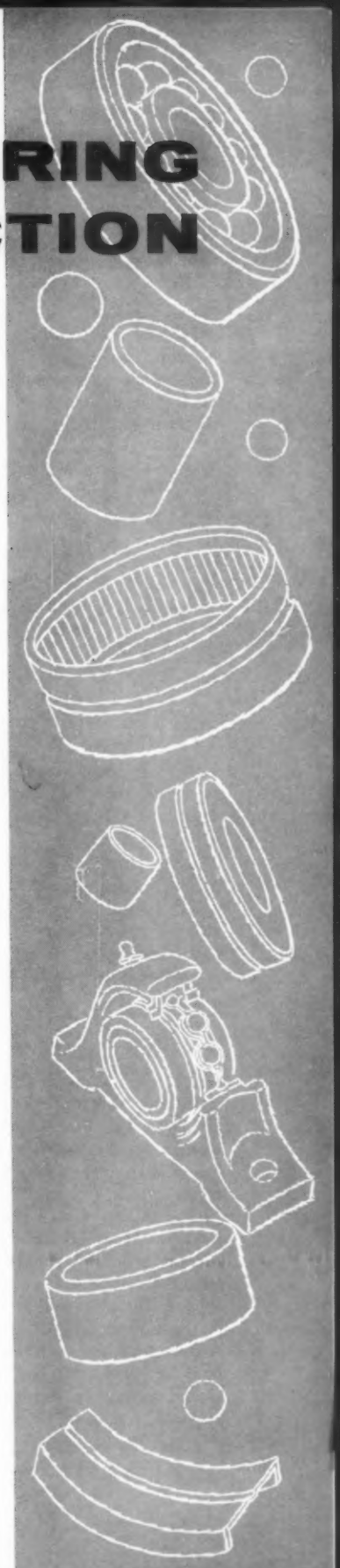
BEARING SECTION



Of Bearings and the Bearing Business

AB Svenska KullagerFabriken (Swedish Ball Bearing Co.), 17 Artillerigaten Fack, Goteborg 1, Sweden is planning to expand capacity of its Goteborg plant by 25% according to a recent U. S. Dept. of Commerce bulletin.

Robert A. Sochar, has been made manager of original equipment manufacturer sales for ball and roller bearings for the Link-Belt Co. bearing plant, Indianapolis, Indiana. The newly created position will give more attention to this sales area.

Sochar has been with Link-Belt since 1945 as a sales engineer. His headquarters will be Indianapolis.

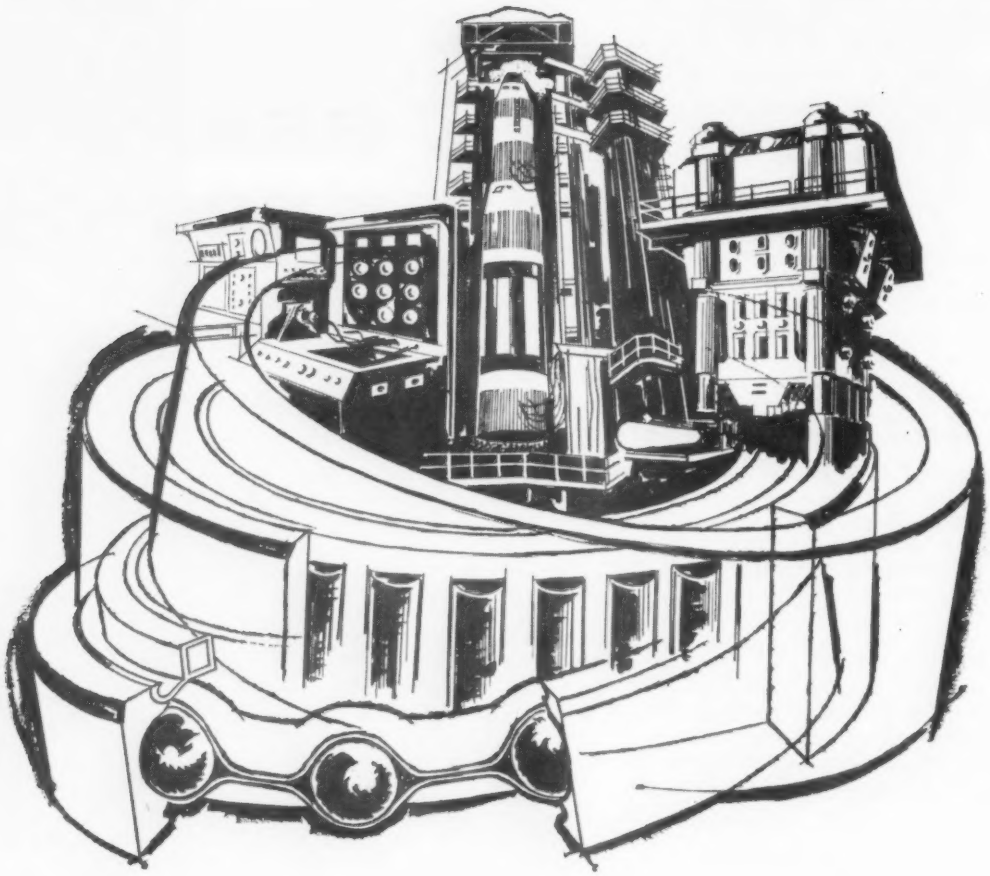
From the *Current Review of the Soviet Technical Press*, a publication of the U. S. Office of Technical Services, we learned of the following articles.

A hydrostatic, air-lubricated thrust bearing, in which shaft vertical bounce (air hammer effect) has been virtually eliminated has been developed at the Experimental Scientific Research Institute of Metal Cutting Tools. An article in *Stanki i Instrument*, No. 11, 1960, by S. A. Sheynberg and V. G. Shuster tells about it.

Air hammer effect was eliminated by using a porous graphite thrust plate. The porous graphite insures adequate air supply and mechanical rigidity. In tests, the bearing worked well at 48,000, 72,000, and 96,000 rpm. Loads were not specified. Method for calculating load-carrying capacity of the thrust bearing and air consumption is included in the article.

Precision burnishing of bearing bores has replaced honing at the Chelyabinsk Tractor Plant. The new process uses a rotary mandrel which incorporates hard balls. Beside being simple and economical the method results in high productivity, work hardening of the surface, repeatability to very high tolerances, and excellent surface finish. This is as reported in an article by Ya. Bukhman, in the Nov. 26, 1960, *Ekonomicheskaya Gazeta.*

Air bearings are used to suspend the rotor of a new memory drum for computer use announced by Sperry Gyroscope Co., Div. Sperry Rand Corp. Sperry engineers used air bearings because they felt that these bearings will let the drum spin at 10,000 rpm for years both here on earth and in possible space applications even though exposed to radiation.



Hot bearing research gives designers new facts

RECENT APPLICATIONS of the long-standing bearing ratings back up a suspicion that has been gaining strength in the industry: The ratings test data—and hence the ratings—are reliable only at test temperatures.

Over a period of 50 years, tests performed on 30- to 45-mm. bore bearings at 3600 rpm and temperatures to about 250 F have formed the basis for the selection of bearings throughout the whole industry. Data from the tests was sufficiently similar to be incorporated in the industry-wide rating system.

Operating temperatures of bearings, however, have been increasing steadily, year by year. This has necessitated some very determined research, on:

- Lubricants
- Bearing materials
- Fatigue mechanisms

Researchers are studying sleeve as well as rolling contact bearings. But because the sleeve bearings are harder to lubricate, they are, so far, less successful at high temperatures.

It is presently thought that bearings which operate above 1200 F will run without lubricants. An exception to this, however, is the molten salt sleeve bearing.

P. G. Smith, in April 1960, reported on work done at the Oak Ridge National Laboratory. Tests performed there indicated that hydrodynamic journal bearings could operate at 1200-1500 F, using a molten salt as the lubricant. Since the salt used solidifies below 860 F, the practical applications of this work are limited.

Liquid Lubricants

For rolling element bearings, recent NASA tests have established a number of suitable lubricant appli-

cation techniques.

Standard liquid lubricants and standard bearing lubrication methods restrict operating temperatures to less than 400 F, since oxidation and loss of lubricant become too severe.

An obvious way to reduce oxidation is to exclude oxygen, by using a closed lubrication system, or one filled with an inert gas. Tests using these methods show that inert gas blanketing could increase the maximum operating temperature of a liquid system as much as 150 F. Later, tests conducted with solid lubricants showed gas blanketing to be just as effective.

A more refined method of raising operating temperatures is to use newly-developed liquid lubricants with improved high-temperature properties. Hydrogenated oils (petroleum fractions) and liquid metals belong in this category.

Hydrogenated oils burn cleanly at high temperatures. This is advantageous because there are no nonvolatile deposits left in the lubricant to shorten bearing life.

Experiments with 20- and 25-mm. bore ball bearings show that lubrication can be effected with a once-through spray. With this technique, a stream of liquid lubricant is pumped through the bearing, and then rejected. At 60,000 rpm and 900 F, test bearings ran without failure when lubricated with a highly refined white mineral oil. Addition of a phosphorus extreme pressure agent reduced cage wear at the limiting operating conditions of temperature and speed.

One disadvantage of spray-on lubrication is the need for a large initial oil capacity. A technique known as once-though mist oil lubrication has been considered to get around this. A spray of atomized lubricant is injected into the bearing, and allowed to find its own way out. It is then discarded.

Experiments covering a speed range from 8,000 to 13,000 rpm at 500 F were run by NASA. The results show that very little oil is required for lubrication of rolling contact bearings by this method. A 75-mm. bore bearing, for example, operated under a 1000-lb. load at $9x10^5$ DN (product of bearing bore in mm., and shaft speed in rpm), and 400 F with an oil flow of 0.003 lb per min. Oil flow was found to be a function of bearing load and DN.

Another disadvantage of spray-on techniques is the difficulty of keeping the stored lubricant cool enough to prevent it from decomposing.

Solid Lubricants

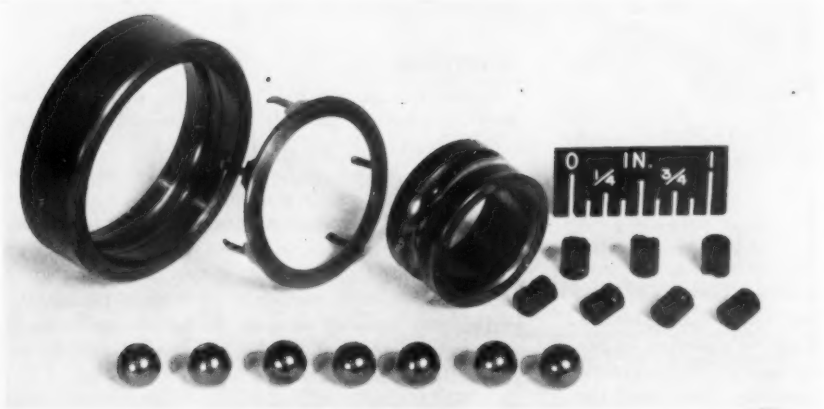
Solid lubricants in loose powder form have been used successfully at temperatures up to 1000 F in rolling element bearings. The best known of these lubricants are graphite and molybdenum disulfide. Recent research has indicated several others that may be valuable.

Meanwhile, these two will both oxidize. Their successful use depends on a continuous flow of fresh unoxidized powder through the bearing, and on use of a suitable bearing material.

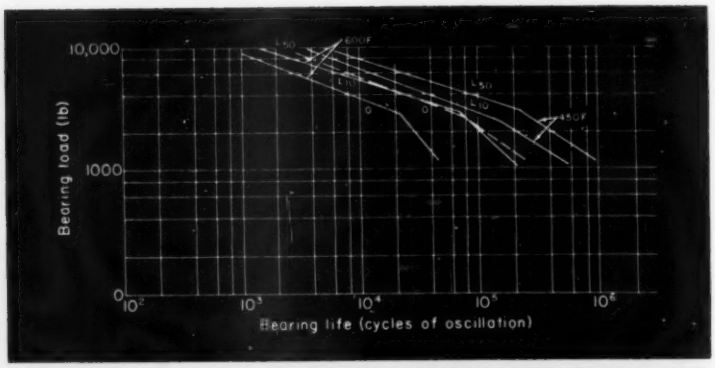
In an experiment, molybdenum disulfide was used to lubricate a ball bearing with beryllium-copper cage. The oxidation product of the lubricant, molybdenum trioxide, reacted with the cage material, and caused bearing failure.

Use of graphite at temperatures up to 1000 F may lead to early failure from an unexpected cause. Under certain conditions, such as running the bearing in dry air, graphite will not lubricate effectively between 150 and 700 F. Effective lubrication with graphite is possible provided either an absorbed water or vapor film is present, or an oxide film of the proper type is continuously present on one or both of the lubricated surfaces.

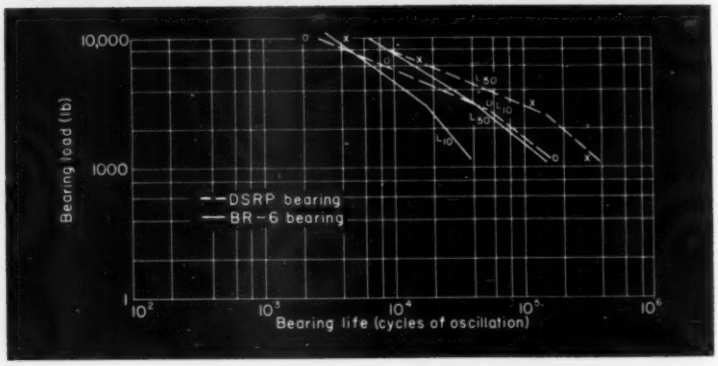
Bonded dry film lubricants are beginning to be tested. Early bonded films used resin binders. They decomposed at fairly low temperatures, restricting the use of the film. Recent work has suggested that certain ceramic-bonded coatings can be used up to 1250 F.



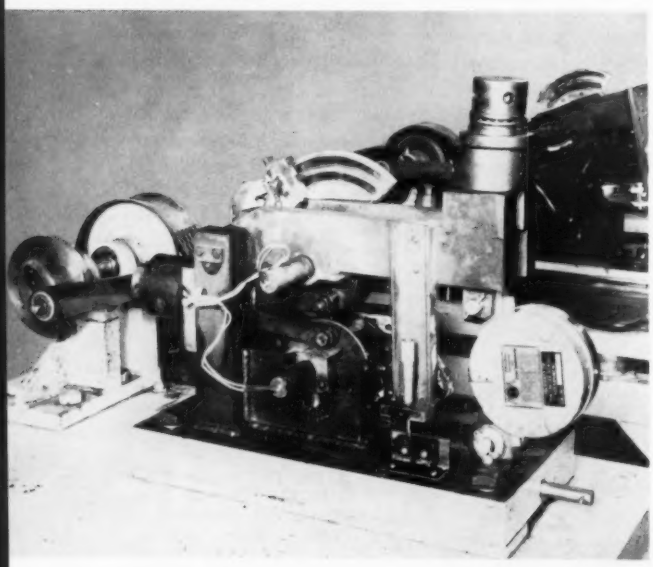
CAGE DESIGNED SPECIFICALLY for high temperature use without lubrication. Carbon rubbing contacts carry very little of the bearing load. Bearing was run dry at 1000 F under thrust loads of 105 lb at 2430 and 5024 rpm. Balls and race of M-10 tool steel, showed no wear after 3 hours of operation. But the carbon button spacers are slightly chipped.



LOAD-LIFE CHARACTERISTICS of rolling contact bearings depend heavily on alignment. For the two types tested here, oscillation amplitudes were varied from ±10 degrees to ±35 degrees. Frequency of oscillation was 250 cpm, loads from 1000 to 10,000 lb. The BR-6 bearings were lubricated every 18 hrs, during testing; the DSRP bearings had no means of relubrication. All bearings were 3/8-in. bore, 1 7/16-in. O.D., high-capacity self-aligning bearings. Cage material for the BR-6 bearing was beryllium-copper.



ONE OF 10 TESTING MACHINES used to apply oscillatory loads to bearings. A test rig designed by two bearing manufacturers was modified for use at 600 F by WADD.



Gaseous Lubricants

The idea of gases as bearing lubricants is not new. Methods of using the gases are varied. They range from the plenum-chamber air bearing to use of the gas as a suspension medium for a lubricating material. At the Wright Air Development Division (WADD), experiments conducted on aircraft bearings attempted the use of dry powdered lubricants suspended in nitrogen. The technique was successful enough to allow bearings to run for 10 hr at 1200 F.

A totally different approach was attempted by William J. Anderson and Edmond E. Bisson at NASA. They used the boundary lubrication effect of halogens in forming low-shear-strength films with metallic rubbing surfaces. Friction and wear measurements showed that lubrication is satisfactory up to 1200 F. However, they emphasize the strong chemical reactions between halogens and iron at elevated temperatures, which make it a very unsuitable bearing material in this instance. They recommend nickel and cobalt alloys.

With this type of gas-lubricated bearing, a run-in period is essential.

Materials

Under the sponsorship of WADD, materials have been explored for possible development of a ceramic rolling bearing to last 2000 hr.

Aluminas in various forms were tested first for use as rollers. The results showed surface finishes were far too poor. With some aluminas, extreme brittleness caused rapid failure.

Basic research on ceramic materials, turned up a number of superior materials for further testing. Selective tests showed titanium cermet to be suitable when rolling on itself. So far, no good way to finish-grind it has been found.

Continued on page 46

ORANGE JOURNAL ROLLER BEARINGS

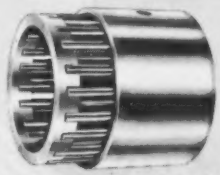
offer many design advantages!

•

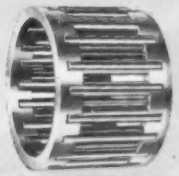
Narrow wall sections and multiple lengths are ideal

--where journal radial space is limited
--where shafts are close together
--where extra journal length is required
--where a wider journal is needed
--or other applications where a space-saving, high-load bearing is desirable

Type JRCS — Sleeve, Cage and Casing for use on unhardened shafts and housings.



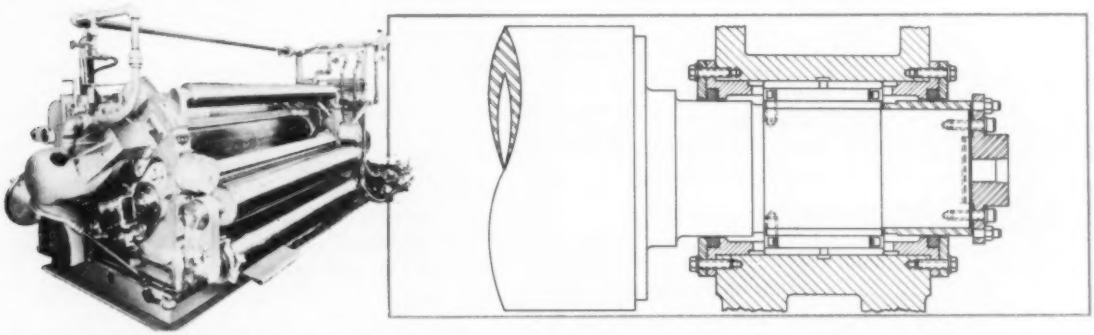
Type JRC—Cage and Casing for use on hardened and ground shafts.



Type JR—Cage Only. Low-cost, space-saving cage-and-roller assembly.

Orange Journal Roller Bearings are narrow-sectioned bearings that fill a place between needle bearings and cylindrical bearings, dimensionally and in load capacity. They are relatively economical, rugged, precision bearings made in three separable parts, usable three ways. Sleeve and casing are made of thru-hardened and centerless ground SAE 52100 steel; machined hard bronze cage retains precision rollers.

It is easy to meet your specific needs in load, bore and length from the many combinations available from stock, including 30 sizes from ⅝″ to 5″ bore, in nine lengths from 1″ to 5″, offering a choice of three to five lengths for each bore.



Drawing shows Orange Journal Roller Bearing in journal of pressure roll in type HKD single facer corrugating machine built by S&S Corrugated Paper Machinery Co., Inc., Brooklyn, N. Y. Bearings are installed at both ends of two corrugating rolls and one pressure roll. Made with precise clearance to allow for thermal expansion in heat reaching 350° F., the bearings ideally meet all load, space and operating requirements.

Write for Orange Reference Manual M-59, giving complete details and specifications of Orange Journal Roller Bearings, plus other Orange Roller Bearings.

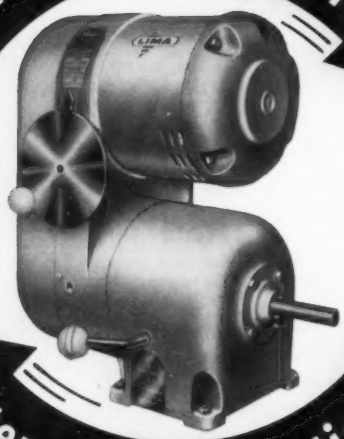
ORANGE ROLLER BEARINGS

ORANGE ROLLER BEARING CO., Inc.
552 Main Street, Orange, N. J.

Needle Bearings — Staggered Roller Bearings
Journal Roller Bearings — Thrust Roller Bearings
Cam Followers

Circle **33** on Reader Service Card

3 times greater torque



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LIMA variable speed drive

LIMA'S multi-speed transmission, as a component of the VARIABLE SPEED DRIVE, delivers this greater output torque . . . at no more cost than comparable 2 to 1 ratio units.

- 120 through 1200 RPM with a 1200 RPM motor
- 180 through 1800 RPM with a 1800 RPM motor

Dripproof or Totally Enclosed Fan-Cooled

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- GEARSHIFT DRIVES
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- GEARMOTORS
- STRAIGHT LINE REDUCERS
- SHAFT MOUNT REDUCERS
- GENERATORS

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THE LIMA ELECTRIC MOTOR CO., INC.
LIMA, OHIO

Circle **53** on Reader Service Card

Tests of cage materials suggested that Stellite Star J, though not up to the hoped-for standard, was the best available material to take the strains imposed without undue wear.

Successful dry rolling element bearings must be made of the proper materials, too. A natural choice for an unlubricated material is graphitic carbon reinforced with a high-strength steel. Any other extremely low-friction material could be used, but it must be strong enough to carry the cage stresses. Clevite Corp. has applied for a patent on an iron base alloy with a coefficient of friction of less than 0.1 sliding against itself.

Comprehensive surveys of possible ring and ball materials take into account friction and wear data, physical properties, manufacturing problems, and reproducibility of materials. Physical properties include hardness, modulus of elasticity, and coefficient of thermal expansion. Rolling contact bearings need a strong, yet light, retainer. Wear debris must be allowed to escape with as little restriction as possible. Ball pocket clearances and surface finishes are extremely critical; clearances must allow for ball control, yet be adequate for differential thermal expansion.

Fatigue

Fatigue, and its high-temperature cousin, creep, are difficult to estimate because there is little data for materials that are suitable for high-temperature bearings.

Early fatigue data for molybdenum-base tool steels indicate that, at room temperature, they are probably not as fatigue-resistant as SAE 52100. Reductions in fatigue life for air-melted heats of molybdenum-base tool steels at 450 to 500 F have been noted. Improved cleanliness (that is, lack of inclusions), markedly improves fatigue properties. Consumable electrode and induction vacuum melting are ways to produce cleaner materials.

Very little data is available for bearing material fatigue strengths above 300 F. Preliminary data is being assembled in laboratories around the country, which suggests that, in general, the harder the material, the better its high-temperature fatigue life. ◆

REFERENCES

1. Wm. J. Anderson and Edmond E. Bisson—*NASA Research on the High-Temperature Bearing Problem.* SAE Paper presented at the Aeronautic Meeting, April, 1960
2. John H. Johnson—*Recent High Temperature Bearing Developments.* SAE Paper presented at the Aeronautic Meeting, April, 1960
3. P. C. Hanlon—*Recent Developments in High Temperature Bearings and Lubricants.* SAE Paper presented at the Aeronautic Meeting, April, 1960
4. P. G. Smith—*High Temperature Molten Salt Lubricated Hydrodynamic Journal Bearings.* ASLE Paper presented at the Annual meeting, April, 1960
5. E. N. Kleingard—*Fundamental Processes in Lubricating Metal Surfaces at 100 F to 1700 F.* ASLE Paper presented at the Annual Meeting, April, 1960.

PRODUCT NEWS

To get complete information on these products, use the Reader Service Cards bound into this issue.

Heavy duty fractional reducer

Type 2-5/8A speed reducer provides ratios from 5-4/5:1 up to 100:1, handling inputs of ¼ to 2 hp at 1800 rpm and ¼ to 1½ hp at 1200 rpm. It's a right-angle drive, horizontal-worm type, fully enclosed, built for continuous duty in stokers, conveyors etc. The case-

hardened and ground alloy steel worm is integral with its shaft. Nickel bronze worm wheel has alloy steel heat-treated shaft. Ball bearings are used throughout. Oil-tight semi-steel housing contains all bearing supports which eliminates split bearings and ensures permanent alignment. Base is also semi-steel, and includes a large oil reservoir. Furnished with input or output shafts on either side of the housing, or both sides.

Abart Gear & Machine Co., Chicago, Ill.

Circle **200** on Reader Service Card

Linear actuator

A linear actuator uses a dc motor to operate a precision ball screw

and provides 500 lb over a 6 in. stroke. Rate of travel is fixed but can be factory-adjusted as required up to 10 in. per minute. Maximum allowable compression load is 2500 lb. Temperature range is −65 to 300 F. Unit operates on 27 to 100 vdc; universal ac/dc operation is also available. Dimensions: 14 7/16 in. long by 1 3/4 in. wide by 3 3/4 in; weight, 3 lb 14 oz.

Globe Industries, Inc., Dayton, Ohio.

Circle **201** on Reader Service Card

Chain drives for gas turbines

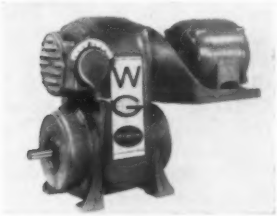
Chain drive for small gas turbine engines—30 to 1800 hp—can transmit rotating power between parallel shafts at high speed, in main or auxiliary drives. Called Hy-Vo (high-velocity involute sprocket), it has compensating links that cut out the chordal action normally met at very high chain speeds. Features: stock pitches, (⅜ to 2 in., 2 to 24 in. width) can handle any combination of center distance and compounding requirements; work load distributed over a minimum of 13 teeth; and a misalignment capacity far in excess of gears.

Morse Chain Co., Ithaca, N. Y.

Circle **202** on Reader Service Card

Mechanical variable speed drive

Vari-Master drive comes in three sizes with hp range from 1 to 10 and ratios of up to 8:1, in either drip-proof or totally-enclosed construction. The standard NEMA "C" face motor, with standard shaft extension can be of drip-proof, totally enclosed or explosion-proof. Design points: fan on the variable speed shaft to cool the belt; shaft shoulders to position the discs and avoid belt misalignment; constant speed disc assembly, saddle-mounted on its own bearings; all bearings double sealed and permanently lubricated; shafts and keys heavy chrome plated; discs with large grease reservoirs. The



helical reducer comes in double, triple and quadruple step reduction, with a variety of assemblies, both horizontal and vertical, and can be equipped with hand, electric or pneumatic controls.

Western Gear Corp., Industrial Products Div., Los Angeles, Calif.

Circle **203** on Reader Service Card

Flat transmission belts

Stocked in circumferences from 10 to 150 in. for any width from 3/16 to 5 in. Developed for maximum

efficiency at speeds up to 75,000 rpm, over pulleys with diameters as small as 5/8 in., this belting is bonded to reduce friction and is unaffected by heat, damp or oil.

Walters Belting Industries, Inc., Buffalo, N. Y.

Circle **204** on Reader Service Card

Variable speed pulleys

A line of variable speed pulleys rated at 20 to 25 hp at 1750 rpm, and at 10 to 15 hp at 1150 rpm, provide instantly variable ratios up to 3:1. Known as No. 320 and 325, the pulleys use a No. 27 (2¾ in.) top width variable speed belt.

They can be used with a number of NEMA frames including sizes 215, 254, 254U, 256U, 284, 284U,

PRODUCT NEWS

286U, 324, 324U, 326, and 364. Standard bores are 1¼, 1⅜, 1⅝, and 1⅞ in. with a 3¾ in. bore length. Maximum pitch dia. is 13.1 in., minimum is 4.35 in. Overall dimensions are 14¾ in. long by 13⅝ in. OD. A feature is the specially curved pulley faces which maintain full belt contact at all speeds and pitch diameters. Dynamically balanced to .02 oz-in.

Lovejoy Flexible Coupling Co., Chicago, Ill.

Circle **205** on Reader Service Card

Two new angle drives

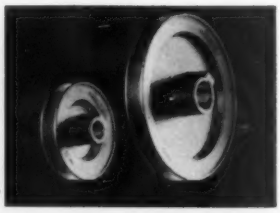
The 9056HF (T-drive) and 9056-119 (right angle drive) have ¾ dia. shafts cut to a 1/16 in. flat for stronger attachment to coupling ends. Primarily for flexible shaft-

ing, these new adapters allow for a variety of other connections. Construction of both drives shows an aluminum housing, steel gears and oil-impregnated bearings. Ultimate static torque capacity is 25 lb in. with a backlash of 6 degrees. Drives weigh 4 oz and 3⅜ oz respectively. Furnished in gear ratios of 1:1, 1:2, and 2:1, with other ratios available on special order.

F. W. Stewart Corp., Chicago, Ill.

Circle **206** on Reader Service Card

Driver pulleys



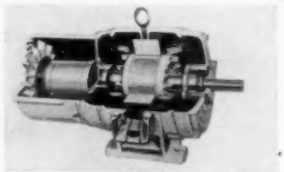
Increased strength of a line of driver pulleys results from the redistribution of metal to provide for heavier cross sections in the critical area where the pulley flanges merge. Statically and dynamically balanced, these pulleys are intended for power mowers and tools where there is frequent overloading of the drive mechanism. Available in ½, ⅝, ¾ and 1 in. bores with standard key way, in pulley diameters from 1⅞ to 16 in.

Congress Drives Div., Tann Corp., Detroit, Mich.

Circle **207** on Reader Service Card

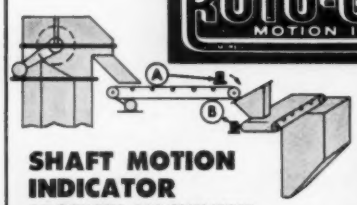
Rapid-reversing motors

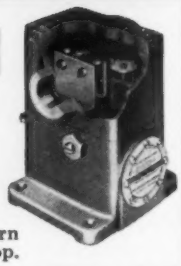
Motors are offered in a complete line of integral hp, polyphase ratings, in open drip-proof, totally enclosed fan cooled and non-ventilated enclosures. Also available with an integrally mounted blower. Designed for high production machine tool applications, they perform up to 125 idle reversals per minute in the smaller open-type sizes and over 200 idle reversals for the blower-cooled design.



Stator and rotor construction; stators have large specially-shaped slots for maximum copper in windings. Rotors in smaller sizes are cast aluminum with special slot design

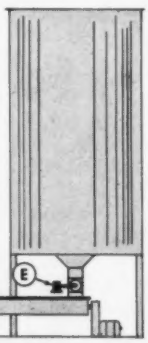
ROTO-GUARD
MOTION INDICATOR





SHAFT MOTION INDICATOR
PROTECTS MACHINERY BY INDICATING STOPPAGE DUE TO OVERLOADING OR MALFUNCTION

A and B: On end return idlers, warn if conveyor should break, slow or stop.
C: On boot pulley, signals slowdown, stoppage, slippage due to overload, boot pulley out of adjustment. Helps prevent fires.
D: On screw conveyor, warns of slowdown due to overloading. Prevents damage.
E: On rotary feeder, warns of slowdown; prevents plugging damage.
Roto-Guards can be wired into interlock system; stoppage of one component automatically stops others; prevents damage.



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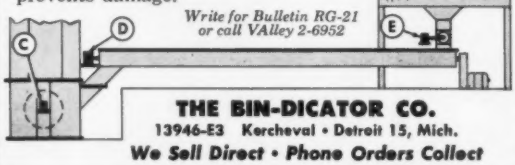

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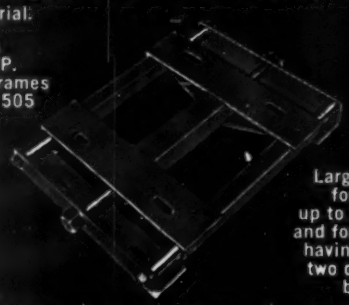
- Excessive maintenance time and expense.
- Poor belt and bearing life.
- A drive in an inaccessible or isolated location.
- A high-ratio short-center drive.

MOUNTING THE MOTOR ON AN "AUTOMATIC" BASE MAY PROVE TO BE A SIMPLE AND ECONOMICAL SOLUTION

Motor mounting position and direction of pulley rotation are immaterial.

Stock Sizes
¼ to 125 HP.
for NEMA frames
56 through 505
and 445-U



Larger Sizes for motors up to 500 HP. and for motors having one or two outboard bearings.

AUTOMATIC MOTOR BASE CO.
WINDSOR, N. J.

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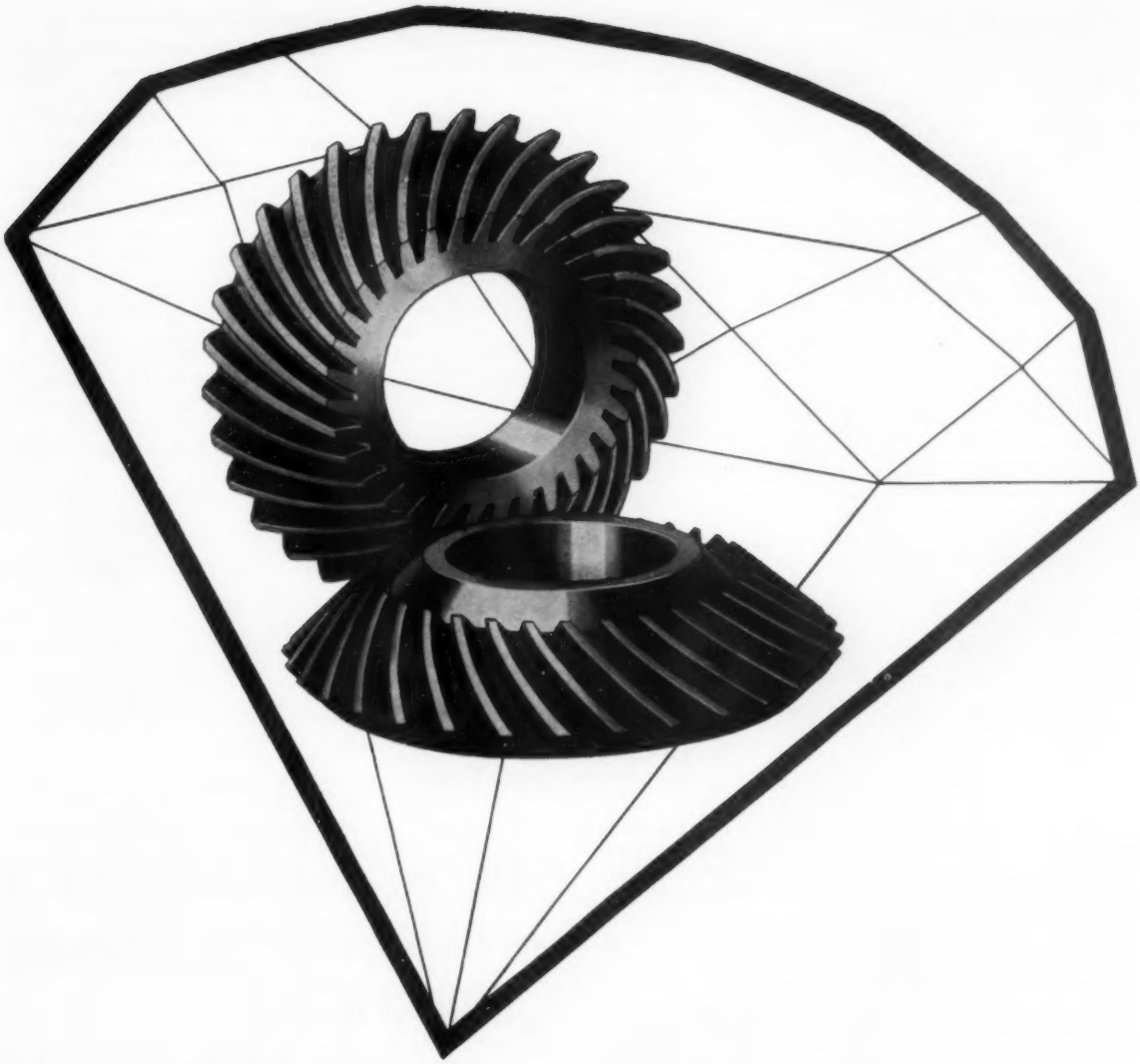

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Custom Gear Makers Since 1907 GEARS, good gears only

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PRODUCT NEWS

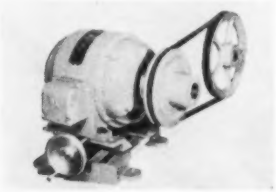
and low inertia construction. Larger sizes employ high resistance bar rotors. Other features: Class A insulation, with Class B and H available; multi-speed designs for tools with slow infeed and faster withdrawal; and rolled shell shaftless designs for direct built-in drives.

The Louis Allis Co., Milwaukee, Wis.

Circle **208** on Reader Service Card

Adjustable motor bases

Models MB-11 and MB-12 adjustable motor bases may be used with



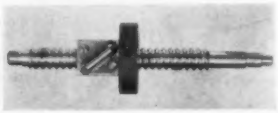
Speed Selector standard M-type spring loaded sheaves (or similar types) for a low-speed drive from ¾ to 10 hp. A handwheel controls speed variation but remote control can be provided. Speed indicator and comparator scales for setting the drive; screw control is self-locking. Construction: precision-machined cast iron.

Speed Selector Inc., Chagrin Falls, Ohio

Circle **209** on Reader Service Crad

Freewheeling ball bearing screw

A line of ball bearing screws limits the travel of the nut at fixed positions with continuing rotation of the screw. This is done with a



simple freewheeling device built into the nut assembly and by providing a stop in the screw at each end of the desired nut travel. Load carrying capacities are the same as equal-sized conventional screws, mechanical efficiencies from 90 to 95%. Possible uses include positioning machine tables and press dies and precisely controlling the speed of various devices.

Saginaw Steering Gear Div., General Motors Corp., Saginaw, Mich.

Circle **210** on Reader Service Card

Graphite lubricant

Mexacote is a quick drying, nontoxic, graphite-lubricant blended from Mexican graphite and oils. Can be thinned with turpentine, naptha or oleum spirits and is easily applied by brush or swab, to form a tough and durable coating suitable for heavy equipment. Packaged in 1-gal cans.

United States Graphite Co., Div. of Wickes Corp., Saginaw, Mich.

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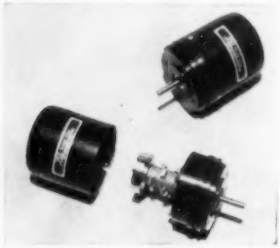
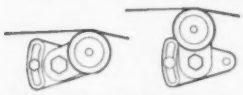
Adjustable limit stop

This assembly provides fully-adjustable rotational limit control within a range of 30 to 4,530 degrees. Comes with ball or oil-less



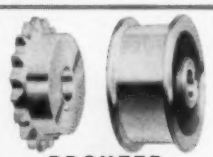
bronze bearings. Self-contained, in a black anodized case, 1⅝ in. dia. (Size 18). Adjusted by setting a series of washers, each governing

Controlled tensioning eliminates shock loading through excessive chain vibration, and horsepower loss through belt slippage.



- ROTATING ARM ACTION FOR GREATER ADJUSTMENT
- FULL 360° POSITIONING

A low cost tensioner for single and multiple width drives that is more adaptable to machine frames. *See your Power Transmission Distributor* or write . . .



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1441 N. 2nd St: St. Louis 6, Mo.

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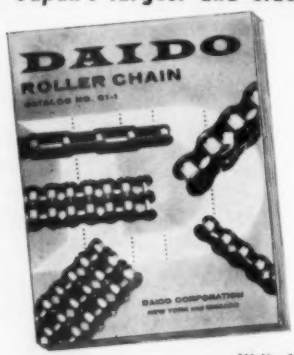
YOU, too, can REDUCE COSTS yet GUARANTEE top performance with DAIDO ROLLER CHAIN

precision manufactured to ASA standards by Japan's largest and oldest chain manufacturer.



Successfully used by large American manufacturers of quality products.

We can supply chain in regular lengths and also in special cut lengths if desired.

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shows every type in actual size. Prompt shipments on all sizes.

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NEW YORK Office: 220 Church St., New York 13, N. Y.
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Circle **52** on Reader Service Card

300 degrees of rotation. Company will pre-set any unit without charge.

P I C Design Corp., East Rockaway, L. I.

Circle **212** on Reader Service Card

Battery-powered dc motor

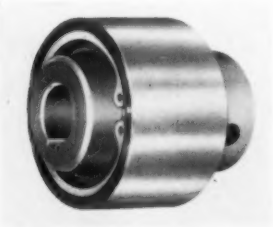
A four-lead series-wound dc motor for battery-operated equipment is rated at ½ hp at 5000 rpm, 24 v. Normally applied through belt, chain or gear drives, the motor speed may be varied by adding resistance to the motor circuit or switching battery voltages. Weight 13 lb, dia. 4 in., with open ball bearings. Has a special rabbetted flange with four ¼-20NC2B drilled and tapped holes, for end mounting.

General Electric Co., Schenectady, N. Y.

Circle **213** on Reader Service Card

Overload protector

New overload protector coupling called the Torq-Tender is war-



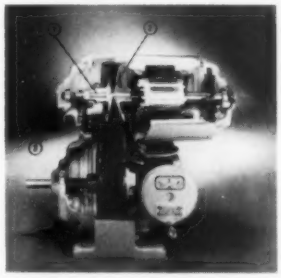
ranted for one million disconnect-reconnect cycles or for six months. Fits motor and machine shafts from ⅜ to 1⅛ in. diameter, and can be ordered pre-set to disengage at any torque setting from ½ ft-lb to 60 ft-lb. Can also remain for an unlimited time in the disengaged position without overheating or binding. Automatically re-engages in the same position when overload is corrected, or motor is operated at low rpm, or turned off and started again. Usual torque ratings and bores plus custom service.

Helland, Inc., Navarre, Minn.

Circle **214** on Reader Service Card

Lube-free drive

All bearings of this variable speed drive are sealed and shielded, and shaft surfaces are impregnated with a tough and wear-resistant material that removes the need for lubrication. Keys and bushings are also of wear-resistant material, so there's no fret corrosion or sticking pulleys. Produced in ¼ to 25 hp, with output speeds from 4660 to .4 rpm in speed variations up to



10:1. Drip-proof, totally-enclosed fan-cooled and explosion-proof models are also lube-free. Suitable for installation in inaccessible positions.

Sterling Electric Motors, Inc., Los Angeles, Calif.

Circle **215** on Reader Service Card

Cantilever thrust bearing

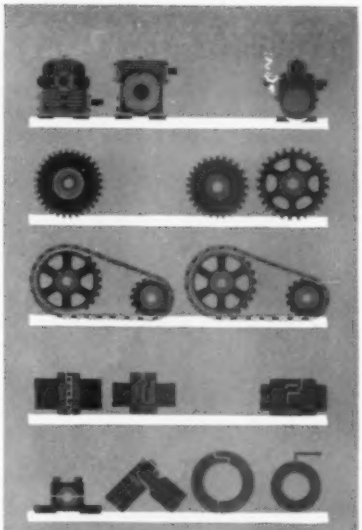
Designed to reduce bearing failures caused by lack of squareness between shaft and housing, this new type bearing can withstand deflection loading. Bearing plates are finished on one side for applying load to roller assembly. Stepped construction requires thicker plates than usual and this thickness is calculated so that the working surfaces of the plates are maintained parallel where the rollers contact. Crowned rollers reduce end stresses between rollers and thrust plates for increased thrust capacity. Design advantages are reduced size of shaft forgings and housing castings and lowered tolerances in shaft and housing machining.

Rollway Bearing Co., Syracuse, N. Y.

Circle **216** on Reader Service Card

Pocket-size dynamometer

Torque and power loading of electric motors can be accurately measured with this 2½ lb instrument. It's installed by slipping onto the shaft and tightening the collet by hand. Interchangeable collets fit a wide range of shaft sizes. A self-



INSTANT SOURCE

Charles Bond's large factory and distributor stocks provide an ideal "instant source" for Power Transmission Equipment for today's replacement and design applications. Frequently, the use of a Bond stock component eliminates the need to create a new component—with attendant delay and expense. When required Bond does create special units to your specifications.

Remember Bond—a leader in the power transmission field for three quarters of a century.

AGMA MEMBER

SEE YOUR NEAREST BOND DISTRIBUTOR

or check with Charles Bond Co. for: speed reducers—gears—flexible couplings — sprockets and chains—universal joints—collars —pillow blocks.

Write for Catalog No. 100

CHARLES BOND COMPANY

617-23 Arch Street, Phila. 6, Pa.

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PRODUCT NEWS

contained V-belt pulley adjusts from 2 to 3½ in. dia. An adapter provides direct drive to hubs, spokes, gears etc. The dynamometer is viewed by a stroboscopic tachometer; transmitted torque is read from its dial, and rpm from the stroboscope dial. Horsepower is then calculated or read from a chart. Measures torque up to 22 in. lb. in either direction within one half per cent accuracy. A double spring prevents centrifugal force from shifting the zero.

Micro Pump Corp., Danville, Calif.

Circle **217** on Reader Service Card

"G Frame" ac motors

The "G Frame" series of ac motors offer hp ratings from 1/400 to ¼; induction or hysteresis synchron-

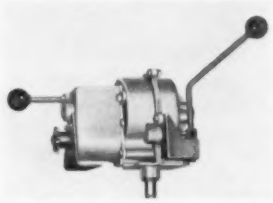
ous; self-cooled or totally enclosed; finned or plain. Operates on 60 cps, 1 or 3 phase, 2 or 4-pole speeds. Ambient range −55 to plus 125 C. The "G Frame" is produced with or without mounting base. Finned version has a dia. of 3¾ in., plain unit measures 3 5/16 in. dia.

Air Marine Motors Inc., Amityville, N. Y.

Circle **218** on Reader Service Card

Two speed transmission

A right-angle reversing transmission, Model P-334, with two



speeds forward, reverse and neutral, is primarily designed for vertical engines up to 5½ hp. Reduction in high speed is 2:1 and in low 3.4:1. Maximum recommended input speed is 1800 rpm. Forward, neutral and reverse are controlled by the shifter lever incorporated in the right-angle half of the transmission. Compact (weighs 14 lb), and may be mounted in any position. Regularly supplied with an 8-tooth #41 sprocket but variations in assembly and components available.

The J. B. Foote Foundry Co., Dearborn, Mich.

Circle **219** on Reader Service Card

Lever grease guns

These models are identical except for the follower setting. Model 1169 is set to handle lube cartridges and Model 1142 dispenses bulk grease. However, by flipping the follower to the correct position, either gun can handle cartridges or bulk grease. Both models feature three-way reloading (cartridge, from filler pump or by suction) and high pressure operation (up to 10,000 psi grease pressure).

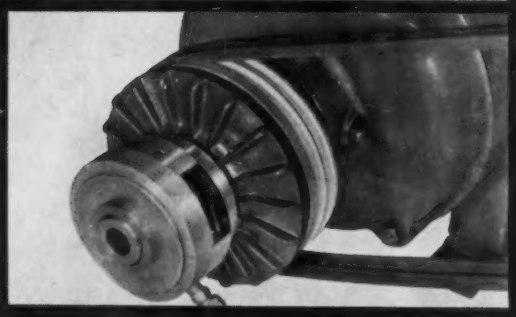
Lincoln Engineering Co., St. Louis, Mo.

Circle **220** on Reader Service Card

Small package motor

Unusual feature of the Duty Master D-5000 is a round stator inside a nearly square frame. Advantages of this are better cooling and smaller overall dimensions for a given hp rating. The cooling system draws air through large intakes at each end, ducts it through the rotor and stator and expells it at the sides. The D-5000 covers 125

HORTON



NEW! "AIR-CHAMP" CLUTCHES*
have built-in rotary Air joint! Mount anywhere!

A combination clutch and sheave, the "Air-Champ"* automatically tunes trouble out of starting problems. *Gives shockless starts!* Installs easily . . . anti-friction bearings . . . "V" belt or pilot adapter type drive . . . control with static air pressure. 2 models; up to 800 inch lbs. of torque. Write us for brochure. *Patent Pending

HORTON MANUFACTURING CO., INC.
1179-15th Ave. S.E., Minneapolis 14, Minn.

HORTON
Over 3 Decades of Dependable Service

Circle **25** on Reader Service Card

This Compact FUNK Unit *SAVED* Space

On this Jaeger concrete mixer, a FUNK-designed double right angle drive provides perfect alignment and positive chain adjustment. Mounted vertically on the "unitized" front trunnion stand, FUNK's unit takes up only a fraction of the space normally used in such applications.

Just one example of how FUNK MODULAR POWER UNITS may be combined — in an unlimited number of arrangements — *without* special engineering costs.

Let FUNK help solve your power transmission problem.

FUNK MFG. CO. Box 577-G, Coffeyville, Kansas

Circle **20** on Reader Service Card

thru 300 hp with standard drip-proof enclosure (splash-proof available), sleeve or ball bearings. Class

B insulation is standard, with encapsulated stators for severe conditions. Frames and end louvers (removable) are cast iron. Either 220, 440 or 550 line voltages for 3600, 1800, 1200, and 900 rpm.

Reliance Electric and Engineering Co., Cleveland, Ohio.

Circle **221** on Reader Service Card

Shaft bearings

Twenty variations of the same basic shaft bearing include a sealed shaft bearing capable of operating in water; enclosed end bearings for jobs in which the shaft does not extend through, as in fans and gas blowers; a shaft bearing with a load capacity of 200 psi of projected bearing area, for such applications as radial saw arbors.

Bearing designs are based on use of Permawick self-wicking lubricant which continuously recirculates oil to bearing surfaces over a temperature range of −40 to 200 F. For shafts with nominal dia. of ⅜, ½, ⅝ and ¾, with a variety of outside diameters and special shaft contours.

Tann Bearing Co., Div of Tann Corp., Detroit, Mich.

Circle **222** on Reader Service Card

Electronic adjustable drives

Two more sizes in the Series 25 adjustable speed drives, Size 3,

Eliminate "high-cost specials" by standardizing on

AMERICAN STOCK GEARS

Investigate and you'll probably find that instead of having to go to the added time and expense of ordering special gears, that your needs can be filled from the American line.

American is a 'complete' stock gear line. Manufactured by Perfection — a veteran of over 30 years in the gear business — these gears are made to the most precise standards, from the highest quality materials. This popular line includes brass, bronze, steel, semi-steel, cast iron, and non-metallic gears in a range of 48 to 3 diametral pitch.

You'll save time and money . . . save on inventory . . . simplify purchasing and have less lost production time by procuring your stock gear needs from your nearby distributor of American Stock Gears.

Ask for FREE copy of American Stock Gear Catalog No. 360 containing detailed information and engineering data.

AMERICAN STOCK GEAR division

Perfection Gear Co., Harvey, Illinois

Circle **3** on Reader Service Card

PRODUCT NEWS

rated at 3 hp max. and Size 4 at 7½ hp. Sizes 1 and 2 covered ratings to ¾ hp. The series uses dc motors powered by two thyratrons in a full wave circuit. Speed ranges up to 100:1. By controlling the thyratron tubes with a magnetic amplifier, drives will hold set rpm within 2 or 3% under varying loads. Drift is one or two tenths of a per cent of set speed after warmup. Sizes 3 and 4 include reversing and dynamic braking. Systems sold with or without enclosure. Standard input is 230 v, 60 cycles with other voltages available.

Cleveland Machine Controls, Cleveland, Ohio.

Circle **223** on Reader Service Card

Vibration monitors

Transistorized models V/p-2 (ac) and V/p-T (dc) work in conjunction with magnetic pickups. Three vibration ranges: 0 to .1 mils, 0 to 1.0 mils and 0 to 10 mils. On most sensitive range, 0 to 100 micro-inches, monitor can measure vibration amplitudes below 10 micro-inches and detect changes of 1 or 2 micro-inches. Model V/p-2 for pipe line service, works on 48 or 60 vdc (ac line only actuates a calibration circuit). Optional feature on Model V/p-T maintains continuous vibration protection during start-up period.

Indikon Co., Watertown, Mass.

Circle **224** on Reader Service Card

DC electronic governor

A heavy-duty electronic governor for precise control of shunt-wound

dc motors up to one hp maintains constant motor speed at any selected value despite variations in load, line voltage or motor temperature. Operating from a 230 v., 50-60 cycle single phase line, governor is available as a stripped chassis for incorporation into other equipment, as a rack mounted-unit, or as a self-contained unit enclosed in a cabinet.

Linde Co., Div. of Union Carbide Corp., New York, N. Y.

Circle **225** on Reader Service Card

Low-cost limit switch

List prices of standard models of a new proximity limit switch including the completely transistorized control and pickup unit, start at $72. The small-size pickup (1⅛ x 1⅛ x 4¼ in.) is sensitive to both ferrous and non-ferrous metals. Simplified design does away with critical setup adjustments.

Electronic Signals, Inc., Cleveland, Ohio.

Circle **226** on Reader Service Card

Bearing takeup frames

Take any type of bearing—babbitted bronze, ball or roller—in any two-bolt pillow block with mounting holes up to 5/8 in. Horizontal

bearing adjustment from 6 to 24 in. Will mount 143 shaft sizes from 5/8 to 2 7/16 in.

Link-Belt Co., Chicago, Ill.

Circle **227** on Reader Service Card

Exclusive new design!

Oil-Rite

CONSTANT LEVEL OILER

Protects bearings by automatically maintaining a constant oil level.

Compare these BETTER DESIGN FEATURES!

- New top filler cap — no need to remove reservoir
- Rugged reservoir construction — reduces breakage
- Remote mounting if desired
- Extra-high surge level
- Dustproof construction

Only Oil-Rite Constant Level Oilers bring you all these greatly improved features.

There are many applications where they can be used advantageously to maintain oil at a constant level. Ring oiled and anti-friction bearings, gear boxes, pillow blocks, pump housings, etc. are only a few ideal installations.

Let us show you how these and other new Oil-Rite developments can save you costly maintenance and down time through better lubrication.

Complete application engineering service available. Send for FREE catalog today.

OILING SYSTEMS • VALVES
DISPENSERS • OIL GAUGES
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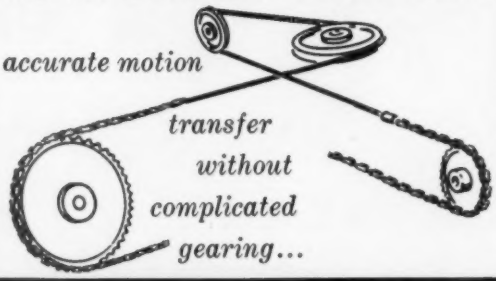
MORE DESIGN FREEDOM



SIERRA MINIATURE MECHANICAL CHAIN AND SPROCKETS...

Provide precise, positive motion transfer through several planes simultaneously with no cable slippage...no complicated gearing. Unlimited center-to-center selection for miniature and sub-miniature assemblies in servo systems, gyro systems, special cameras, electronic equipment, and small precision instruments. Less weight, cost, maintenance —wider tolerances. Designed to operate around minimum 7-tooth sprocket with root diameter of .250 inches. Chain pitch .1475 inches; Weight .45 oz. per lineal ft. Material: stainless steel, or other materials.

NEW CATALOG

Contains useful application data, specifications, tables on chain pitch and sprocket sizes, suggestions for calculating center-to-center distance. *Write for yours today.*

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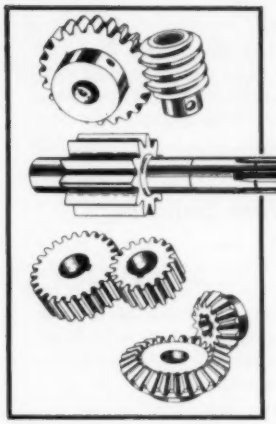


If you use GEARS

Find Out How MICRO'S 2 Way Service Solves Your "GEARACHES"

Efficient gear performance demands skilled design—and accurate manufacture. To help you in both these important areas, MICRO has developed a unique service that combines production facilities with engineering know-how to give you **better gears for better performance.** Whether you buy gears or make your own, it will pay you to investigate this unique gear service.

1. *MICRO Production Facilities*

14,000 square feet of production space is devoted exclusively to the production ot gears at MICRO. A few of the specialized machines in use are illustrated here. These modern machines combined with rigid inspection have resulted in a customer rejection rate averaging less than one-tenth of one percent over the last five years. If you need 100 or 100,000 gears a week, you can count on MICRO to deliver on schedule because of accurate production control. Most important of all, efficient production machines and methods reduce unit cost and improve quality.

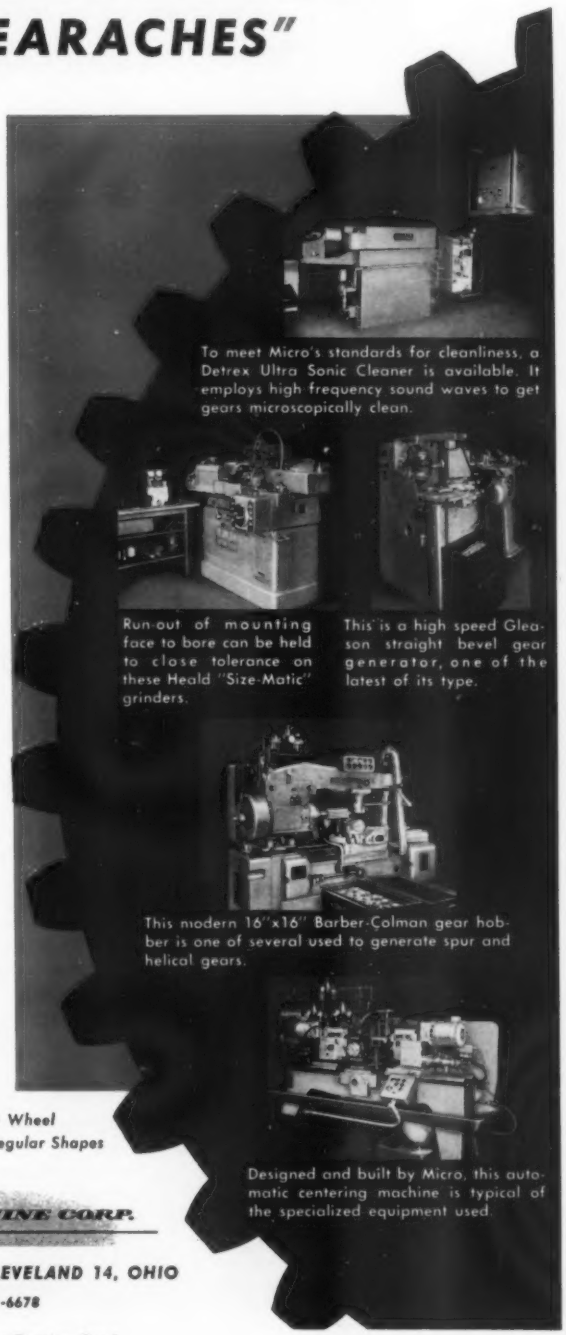
2. *MICRO Engineering Know-How*

Whether you are designing a new product . . . or improving an existing one . . . MICRO'S free engineering service can help you solve problems. You can ask for and get experienced engineering help from MICRO'S staff of gear specialists. It's more than just lip service from a clever salesman — you can expect real help based on the analysis of your loads, speeds and type of service. MICRO gear specialists will help you design gears, select materials, set tolerances, and design mountings. They can advise on assembly or handling problems and many times suggest design changes that will cut costs and improve quality.

Gears are MICRO'S only business. Only specialists can give you this two fold gear design and production assistance. If you want to cut cost and make your product perform better — MAKE MICRO YOUR SOURCE FOR GEARS!

WRITE FOR NEW BROCHURE

To find out more about this new approach to gearing problems send for MICRO'S new 8-page, fully illustrated folder. It's free . . . write today!



To meet Micro's standards for cleanliness, a Detrex Ultra Sonic Cleaner is available. It employs high frequency sound waves to get gears microscopically clean.

Run-out of mounting face to bore can be held to close tolerance on these Heald "Size-Matic" grinders.

This is a high speed Gleason straight bevel gear generator, one of the latest of its type.

This modern 16"x16" Barber-Colman gear hobber is one of several used to generate spur and helical gears.

Designed and built by Micro, this automatic centering machine is typical of the specialized equipment used.

Spur • Helical • Bevel • Worm • Worm Wheel
Sprockets • Ratchets • Splines • Irregular Shapes

MICRO PRECISION GEAR & MACHINE CORP.

designers and manufacturers of fine and medium pitch gears

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Circle **30** on Reader Service Card

LITERATURE

on drives and components

To get free copies of the following literature, use the Reader Service Cards bound into this issue.

Chain and sprocket catalog

Catalog No. 760 has 116 pages on stock chains and conveyor products. Sections deal with standard and special types, heavy and light series, conveyor and block chains, micropitch types and chain selection and care. Includes complete data and selection tables, materials available and parts description. Also covers flexible shaft and Hi-Cap couplings and chain casings. *Diamond Chain Co., Indianapolis, Ind.*

Circle **300** on Reader Service Card

Flexible shaft catalog

Form No. 574, 8-pages, gives details of over 180 flexible shaft assembly variations which can be ordered directly. Spec tables, dimensioned drawings and examples of how to order. *F. W. Stewart Corp., Chicago, Ill.*

Circle **301** on Reader Service Card

Fhp ac motor catalog

This is section of a master catalog listing motors, blowers and fans. Contains instructions on how to select a motor, detailed electric and mechanical specifications, as well as pages of performance curves on typical motors. *Air-Marine Motors, Inc., Amityville, N. Y.*

Circle **302** on Reader Service Card

Belting bulletin

Link-V Belting is composed of individual links made of several plies of rubber-impregnated duck cloth joined by rivets. Comes in standard cross-sections—00, 0, A, B, C and D—in 100 ft lengths on reels. Catalog Section 25A has instructions for assembling, dimensions, selection tables and hp ratings. *Fort Worth Steel and Machinery Co., Fort Worth, Texas.*

Circle **303** on Reader Service Card

Takeup frames

Multi Bearing takeup frames from stock in 11 sizes designed to accomodate any type of bearing—babbitted, bronze, ball or roller in any two-bolt pillow block with mounting holes to ¾ in. Will mount 143 bearing shaft sizes from ¾ to 2 7/16 in dia. One-page leaflet gives all the information. *Link-Belt Co., Chicago, Ill.*

Circle **304** on Reader Service Card

Handbook on nylon

This handbook emphasizes the advantages of nylon as a bearing material. Thorough coverage, with sections on physical and mechanical properties, bearing design and performance, machining procedures and recommended applications. *The Bunting Brass and Bronze Co., Toledo, Ohio.*

Circle **305** on Reader Service Card

Shaded pole motors

Complete specifications of the new Series M shaded pole induction motors, and new models in helical, spur and worm gearmotors. Description includes photos, speed ranges, torque, size, gear details, and optional features such as brake clutch and socket output shaft. Drawings of each series show all important shaft, mounting and outline dimensions. *Brevel Products Corp., New York, N. Y.*

Circle **306** on Reader Service Card

Set screw bulletin

Set screws have a nylon insert which compresses and locks into the thread of the holding member and prevents burring or nicking of precision shafts. Four-page bulletin gives details. *PIC Design Corp., East Rockaway, N. Y.*

Circle **307** on Reader Service Card

Holdback clutches

Twelve-page catalog on holdback clutches, designed to prevent runback or reverse travel of inclined conveyors, bucket elevators, capstans, etc. Explains why and where to use, how they work, and design advantages. Tables and charts cover speed and idler factors, dimensions and mounting data on 12 models in bore sizes from 1 15/16 to 12 in. *Formsprag Co., Warren, Mich.*

Circle **308** on Reader Service Card

Motor controller

The Spacemaker controller is said to be the first starter in the 2000-5000 volt range to use a two-high motor control center. It's available for squirrel-cage, wound rotor and synchronous motors up to 2500 hp at 4-5 kv and 1500 hp at 2.3 kv, in reversing or non-reversing, full voltage or reduced voltage starting. Described in Bulletin 14V9739. *Allis-Chalmers Mfg. Co., Milwaukee, Wis.*

Circle **309** on Reader Service Card

Stitched canvas belting

Four-page pamphlet lists types and treatments of stitched canvas belting in weights of 32, 37½, and 39 oz. Shows typical applications in various industries and has a complete price list by width and ply. *The Hetterick Mfg. Co., Toledo, Ohio.*

Circle **310** on Reader Service Card

Adjustable speed drives

Six-page Bulletin 2900 outlines a line of adjustable speed drives for applications in the ¾ to 2500 hp line. Describes four types of com-

plete packaged drives—the Ajusto-Spede, Magnetic Drive (ac), Select-a-Spede (dc) and Allispede (ac). Covers ratings, speed ranges, type enclosures, associated controls and many standard and special modifications. *The Louis Allis Co., Milwaukee, Wis.*

Circle **311** on Reader Service Card

Drive tensioner

Deals with base and shaft mounted series of the Universal tensioner, with 3 models of each type (S and A Series). Mounting dimensions and illustrations, general engineering information. Also has data tables on bronze bushed idler pulleys for use with V-belts, flat belts and timing belts, and bronze bushed idler sprockets. *Brewer Machine & Gear Co., St. Louis, Mo.*

Circle **312** on Reader Service Card

AC motor spec sheet

Single-page spec sheet contains size, speed and power specifications of a new type of split-capacitor, fractional hp, ac motor, available in ratings from 1/15 to 1/2 hp. Charts and engineering drawings. Points out that motors can be wound for 208 or 230-volt operation as well as 115-v., 60 cycle. *Leece-Neville Co., Gainesville, Georgia.*

Circle **313** on Reader Service Card

Self-aligning bearings

These bearings and rod end bearings are illustrated and described in detail in 56-page, 1961 Catalog No. 551 covering the entire Monoball line. Tells about the new series of Dyflon plastic alloy inserts, and self-lubricated bearings in plain or rod end types. Bore sizes to 6 in. *Southwest Products Co., Monrovia, Calif.*

Circle **314** on Reader Service Card

Turbine pump drive

Catalog 31, 13 pages, gives all the facts on a right-angle gear drive for turbine pumps. Covers the variety of models available for high and low speed prime movers and pumps. Performance curves, spec tables, application photos and some details of the custom service. *Johnson Gear & Mfg. Co., Berkely, Calif.*

Circle **315** on Reader Service Card

Power transmission products

Eight-page Bulletin 7900-B2 covers company line of both constant and variable speed mechanical power transmission products—sheaves, pulleys, belts, motor pulley drives, motor drives. General information and a certain amount of dimensional data. *Worthington Corp., Harrison, N. J.*

Circle **316** on Reader Service Card

Fractional hp motor

Description and design details of the Duty Master FHP, which has a new ventilating system, and a weight reduction of 33% over preceeding designs. Points are illustrated with photos and a life-size photo of a cutaway motor is shown in color. Bulletin B-2514, 8 pages. *Reliance Electric and Engineering Co., Cleveland Ohio.*

Circle **317** on Reader Service Card

Precision gears and clamps

Details complete line of stock precision I, II, and III gears and pre-

NEW!
MANHEIM VARIABLE SPEED BELT

Now Outdates Wood Block and Variable Speed V-Belts

MVS Belt replaces enclosed drive belts without disassembly. Its patented design sets a new standard in V-to-V drives because it is adjustable and is installed in minutes instead of hours. Uniform thickness and width guarantee constant power delivery with no cross-sectional distortion. Available in 26 widths from 1½" thru 5".

Write Today For Complete Information

MVS

MANHEIM
MANUFACTURING & BELTING COMPANY
Manheim 9, Penna.

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Standard, from stock, or Custom-Made to Your "Specs" at Low Cost.

DIE-CUT ROLLER CHAIN Sprockets

76 Standard Sizes, for A.S.A. No's 35, 40 and 41 chains, in stock for immediate delivery.

Also hub types, special holes, ring types and others including sprockets to your own "specs" can be furnished quickly in small lots or production runs.

Dayton Rogers' short run stamping "know-how", the result of 35 years experience, keeps costs down.

Save with die-cut sprockets made by the Dayton Rogers method.

Write for complete details and representative costs or submit requirements for quotation.

DAYTON ROGERS
Manufacturing Company

Minneapolis 7Z, Minnesota

Circle **14** on Reader Service Card

LITERATURE

cision instrument clamps. Complete with diagrams, dimensions and prices in a 128-page pocket-size book. *Perfect Gear and Instrument Corp., subsid. of Liberty Electronics Corp., Inglewood, Calif.*

Circle **318** on Reader Service Card

Chain catalog

Covering the entire company line of power transmission chain drives this catalog provides chain and sprocket engineering and application data based on the new hp ratings proposed by the Association of Roller and Silent Chain Mfrs. Details "MSL" self lubricating chains and sprockets and attachments. A feature is a quick selection chart to find recommended chain pitch numbers. *Whitney Chain Co., subsid. of Foote Bros. Gear & Machine Corp., Chicago, Ill.*

Circle **319** on Reader Service Card

Thinline motors

Eight-page Bulletin GEA-6927B lists features and advantages of Thinline motors for limited-space applications. Shows full line, 1 through 5 hp, in both dripproof and enclosed construction. *General Electric Co., Schenectady, N. Y.*

Circle **320** on Reader Service Card

Optical comparators

Comparator Catalog, Form #6103, takes the reader through a step-by-step demonstration of basic measuring. Other sections detail accessories and illustrate over 20 applications from tiny electronic components to large steam turbine blades. Also contains complete catalog information. *Jones & Lamson Machine Co., Springfield, Vermont.*

Circle **321** on Reader Service Card

Miniature bearing catalog

This miniature and instrument bearing catalog has 40 pages of dimensional information and practical engineering and application data needed to select and specify bearinigs for instruments. Features illustrations of the bearings actual size. *Fafnir Bearing Co., New Britain, Conn.*

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Gearmotors and reducers

Six-page Bulletin MD-1 describes a full line of gearmotors and Line-O-Drive coupled speed reducers. Gearmotors from 1 to 150 hp, ac, single, double and triple reduction, with speeds down to 7.5 rpm. Available in AGMA Classes I, II, III in open, enclosed and explosion-proof construction; either parallel shaft or right angle drive (up to 30 hp). Line-O-Drives from 1 to 75 hp, ac. Output speed tables for hp ratings in all three AGMA Classes. *Howell Electric Motors Co., Howell, Mich.*

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Coupling bulletin

Eight-page Bulletin 1001 features the new TW Drive designed for quiet, low-cost agitation in open or closed chemical vessels. Comes with either seal or stuffing box, fixed or variable speed belts, fixed speed gears or hydraulic systems. Description and specification for each type of drive—fixed speed gear, fixed speed belt, variable speed belt and variable speed hydraulic. *The Pfaudler Co., Rochester, N. Y.*

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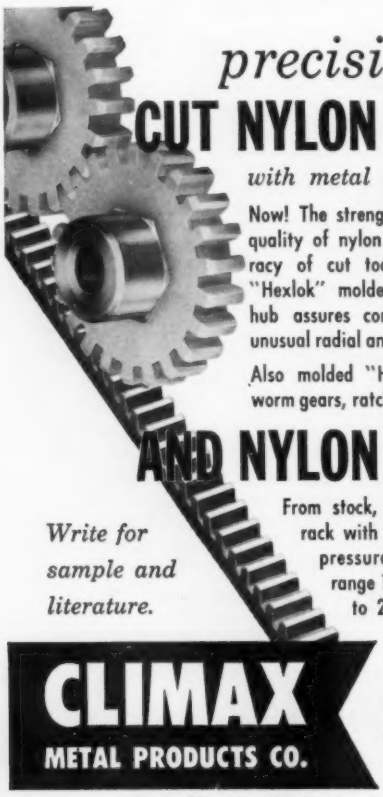

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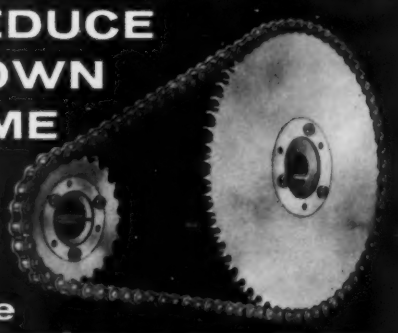

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Agitator drive

Bulletin 4100 presents complete line of torsionally resilient Steelflex couplings. New pages, additional coupling types, dimensions for larger sizes and easier methods of selection are included. Explains how grid-groove coupling design protects connected machines against shock, misalignment, vibration. Charts and tables for engineering data. *The Falk Corp., Milwaukee, Wis.*

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Reducer guide

A shirt-pocket selector automatically gives the correct model Radicon speed reducer for any combination of input speed, ratio or output speed and required capacity. It also gives 20 key dimensions for the selected unit. *Foote Bros. Gear & Machine Corp., Chicago, Ill.*

Circle **326** on Reader Service Card

Cam follower bearings

Bulletin on heavy stud cam follower bearings lists both the CFH and SCFH (sealed) series. Drawings, special features, plus mounting instructions for both series. Also dimensional data for all models, tables for determining speed factors, life factors, proper stud size, minimum boss support and recommended clamping torques. *Bearing Div., McGill Mfg. Co., Inc., Valparaiso, Ind.*

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Self-locking control

A 4-page Bulletin No. 3400-9-60 describes the operation and design of the Quadrastat control which self-locks into any position without creep or position change from feedback forces. Used as throttle control, hydraulic valve control, engine governor control etc. May be manually, hydraulically or motor actuated. *Adams-Rite Mfg. Corp., Glendale, Calif.*

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Gear chassis

The Versa Gear is a new quick change gear chassis which is easily incorporated into any instrument mechanism where gear ratios must be changed or where a specific gear train has to be assembled quickly. An infinite range of ratios are available by changing gears on slideable bearing blocks. Pamphlet gives specifications and price list. *Foster & Allen, Inc., Chatham, N. J.*

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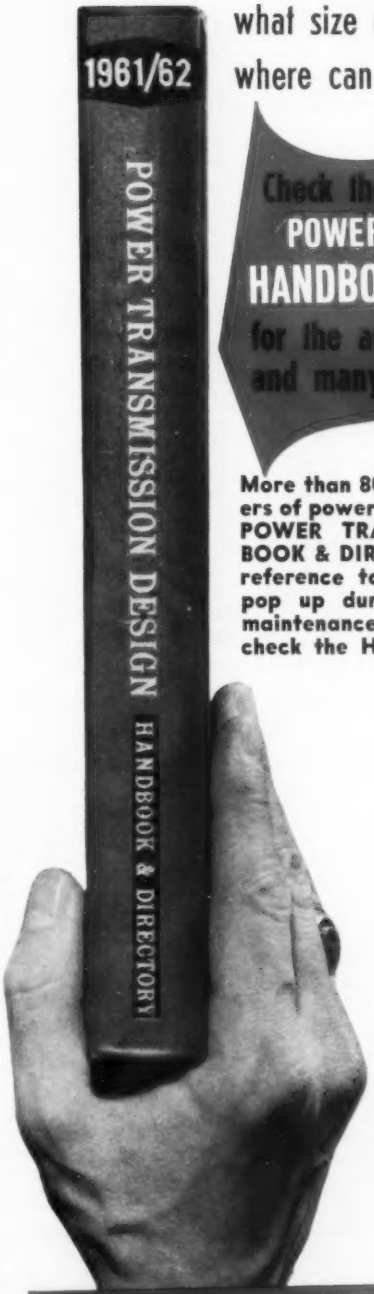

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MEN

of the power transmission field

Former professor named director of engineering

SCHWARTZ

Dr. Frank L. Schwartz, former professor of mechanical engineering at the University of Michigan and consultant to the Atomic Energy Commission, has taken a position as director of engineering for Lauson Power Products Div. of Tecumseh Products Corp. He will head both research and development on two-stroke cycle air-cooled engines from Power Products and four-cycle engines produced by the Lauson Div. He is a specialist in this field as well as in atomic and gas turbine vehicle power plants.

Dr. Schwartz obtained his doctorate degree from the University of Michigan where he was a member of the engineering faculty for 19 years. He is also a member of the organization committee of ASME, chairman of the Aircooled Gasoline Engine Test Code Subcommittee of SAE, former president of Pi Tau Sigma engineering fraternity, among other professional affiliations.

He has published extensively on gas turbine engines and nuclear heat vehicle power plants, as well as on the use of isotopes in measuring wear rates in gear trains and drive mechanisms.

American Metal Climax gets new sales manager

Howard Blank, who joined American Metal Climax, Inc., in 1957 as assistant manager of technical services, has been promoted to sales manager of OFHC brand copper and OFHC alloys. Holder of a degree in metallurgical engineering from Lehigh University, he contributed in large measure to the development of oxygen-free high conductivity copper and its alloys, such as OFHC with zirconium, sulfur, chromium and others. His previous positions include assistant division chief of alloy development at the Battelle Memorial Institute.

Move for Wood's sales engineer

Lloyd A. Wilcox, formerly field sales engineer, home territory, for T. B. Wood's Sons Co., moves to Cincinnati as field sales engineer for that territory. He has been with Wood's for five years and has had experience in manufacturing, engineering and internal sales departments.

WILCOX

ANDERSON

Appoint power transmission sales manager

J. W. Anderson, appointed manager of the power transmission sales department of Hewitt-Robins, Inc., will be responsible for sales of the company's complete line.

Anderson has been in the power transmission field for more than 25 years. Since 1955 he has been handling sales for the company's Union Chain Div. at Sandusky, Ohio. He is a member of the American Petroleum Institute and the Association of Roller and Silent Chain Manufacturers.

Dayco names traffic manager

Eugene R. Knobel succeeds Grant H. Marks as general traffic manager for the Dayco Corp. Marks, who held the post for ten years, resigned to accept another position.

Knobel joined the company in 1953 as assistant traffic manager. He had previously been a traffic analyst for one of the major rubber companies in Akron.

Hupp Aviation appoints "electrodyne" engineer

PLUME

William F. Plume is the new chief "electrodyne" engineer for Hupp Aviation Div., Hupp Corp. Electrodyne valve operators are electromechanical devices used in utility, chemical and petroleum process industries among others.

Plume has 25 years of experience in power transmission with various well-known firms. He joined Hupp Aviation in 1959 as a project engineer. He is a graduate of Drexel Institute of Technology (1935) with a B.S. Degree in mechanical engineering.

Northwestern rep for Diamond Chain

Richard B. Franks now represents Diamond Chain Co., Inc., in the northwestern United States and southwestern Canada. A graduate engineer of Michigan State University, his selling experience in the metalworking industries includes eighteen years of technical sales engineering.

Bennett named Morse market manager

Howard W. Bennett, Morse Chain Co.'s new market manager, comes to the company after 31

years with General Electric, where he was sales and market manager for gear motors and transmission components. He went to G. E. after obtaining an engineering degree from the University of Delaware. He will work in Morse's main office in Ithaca and supervise all internal sales department functions.

New staff assignments from Fafnir

Appointment of two regional and one district manager was announced by Stanley G. Fisher, general sales manager of Fafnir Bearing Co.

R. M. Crum becomes manager of the Ohio region, succeeding R. F. Steeneck who is retiring after seven years in charge of the Cleveland office. Crum, former district manager of Cincinnati, will make his headquarters in Cleveland, assisted by R. T. Culloch.

Taking over in the Cincinnati territory will be W. H. Schauer, who will be assisted by Richard Rival.

E. C. Gauron has been named regional manager of the newly formed Pittsburgh region. He will be responsible for the Rochester as well as the Pittsburgh areas and for warehouse operations in Pittsburgh.

Parker Seal's new rep.

Joseph P. Bowen will represent the Parker Seal Co. in the Minnesota and Wisconsin areas. A BS from Marquette University, he was formerly with Norton, Inc. in Milwaukee.

Liberty Electronics makes two appointments

Liberty Electronics Corp.'s president Irving Zeiger announced appointment of Joseph F. Richards as vice president of its subsidiary, Perfect Gear and Instrument Corp. At the same time Stanley Pomerantz was made general manager.

RICHARDS

POMERANTZ

Richards, former products manager of Sterling Precision Corp., has been active in the manufacture of precision gears and electro-mechanical components for both military and commercial uses since the start of World War II.

Pomerantz was on the managerial staff of Liberty Electronics and was promoted on his return from Europe, where he was investigating marketing procedures.

Three appointments at Hewitt-Robins

Hamilton M. Ross, newly elected vice president of Hewitt-Robins Inc., will be responsible for the company's contract engineering in this country and abroad. He will be assisted by Martin Vander Laan, appointed director of engineering sales with responsibility for world wide sales of bulk material handling systems.

Ross will be succeeded as manager of the Robins Conveyors Div. by Norman M. Godfrey, who has

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been manager of the company's eastern sales region.

Ross joined Hewitt-Robins in 1941 as an engineer, and worked his way up through the various engineering and manufacturing levels to become manager of operations at Passaic in 1952. He is a graduate of Rutgers University and a member of AIME. Godfrey, who has been at Hewitt-Robins since 1937, took a major part in developing the company's vibrating screen department. He was appointed manager of the eastern region in 1951.

Vander Laan has 25 years of experience in the design, manufacture and sale of material handling systems. He has travelled widely abroad and in 1954 served as consultant to the U.S. Government's Foreign Operations Administration.

Tann appoints sales engineer

Albert F. Williams will be sales and service representative for three of the Tann Corp.'s major divisions: Tann Controls Co., Tann Bearing Co., and Congress Drives Div.

Before joining Tann Corp., Williams was a sales engineer for U.S. Rubber's Mechanical Goods Div. An industrial engineering graduate of Lawrence Technical Institute, he has more than five years experience in sales in power transmission and special tool fields.

WILLIAMS

MALONE

Fort Worth Steel names vice president

S. L. Malone succeeds M. S. Jackson, Jr., as vice president in charge of sales for the Fort Worth Steel & Machinery Co. Malone was previously product manager for company's materials handling equipment.

He joined Fort Worth Steel & Machinery in 1940, working first in accounting and subsequently in most other departments of the company. After four years as a partner in a firm distributing industrial equipment, he returned to FWS&M in 1959.

Eastern sales manager for American Pulley

Edward R. Boate, Jr., will handle sales for both power transmission and material handling divisions of the American Pulley Co., for the entire eastern section of the U.S.

Boate, who was formerly the company's district manager for the Cincinnati territory, has a background of 14 years in all phases of the industrial supply business.

New director of engineering for American Standard

Formerly head of the research and development lab at the Kewanee Boiler Plant, Jack A. Hallinan moves up to the post of director of engineering for American Standard's Kewanee Plant.

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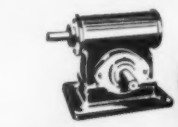

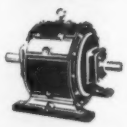

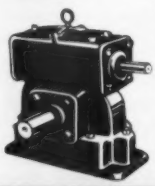

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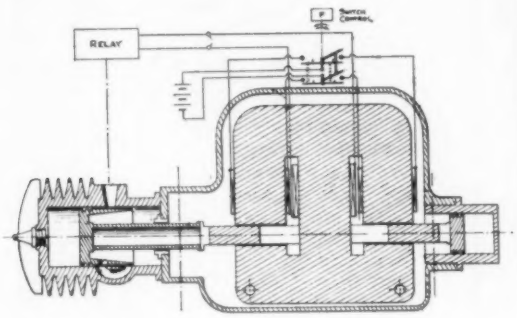
PATENTS

Floating Piston Generator

U. S. Patent No. 2,966,148; Jaques Henri Jarret, Le Vesinet, France, and Jean Marie Baptiste Jarret, St.-Cloud, France.

Reciprocating motion of a piston is used to vary the reluctance of a magnetic circuit. As it varies, inductive

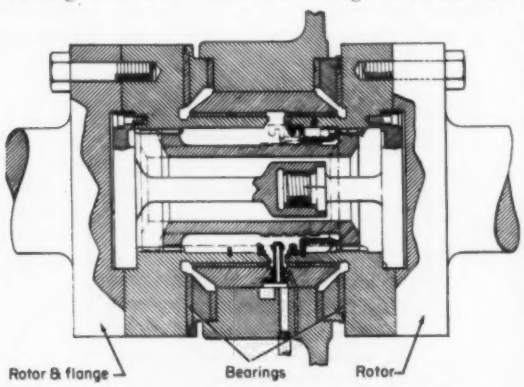


windings generate an alternating electric current. The machine also includes a feedback relay for stabilizing the speed of the reciprocating engine.

Thrust Transmitting Flexible Coupling

U. S. Patent No. 2,964,929; Herbert N. Hoffman, Worcester, Mass., assignor to General Electric Co., New York.

The two flanged shafts are separated by a journal bearing. A flexible thrust-transmitting shaft is fastened



between the main shafts at their centerline. The assembly allows angular misalignment, with little axial displacement.

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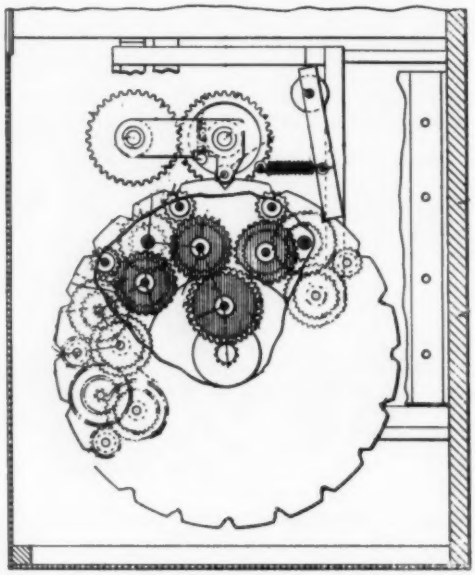
Change Speed Unit

U. S. Patent No. 2,964,960; *Julius Lerner, Drexel Hill, Pa., assignor to Sun Oil Co., N. J.*

Two complete rings of cone gears are concentrically mounted on a base plate. They are meshed so as to form a gear train, every outer ring gear meshing with

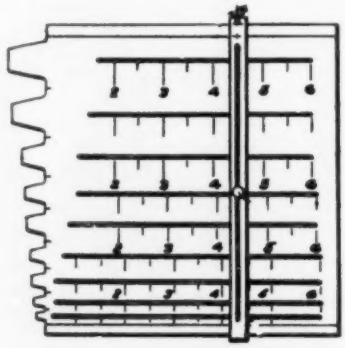


an inner ring gear. One of the gears is driven, and by turning the mount, a stationary gear may be engaged with any of the mounted gears to produce a desired output speed.

Draftsman's Template

U. S. Patent No. 2,963,973; *Paul C. Hendrickson and Donald C. Johnson, Warren, Mich.*

Template for drawing gears. A point can be punched with a pin through a crossbar overlying dimensioned



longitudinal slots. Gears of any pitch diameter can be drawn by varying the position of the crossbar.

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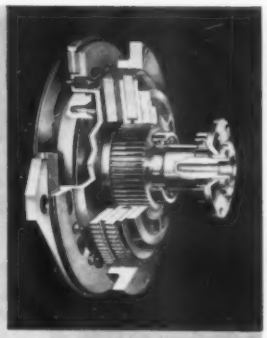

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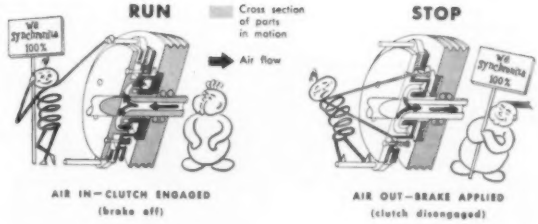

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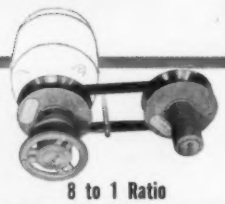

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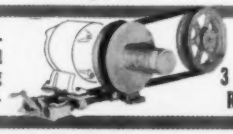

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